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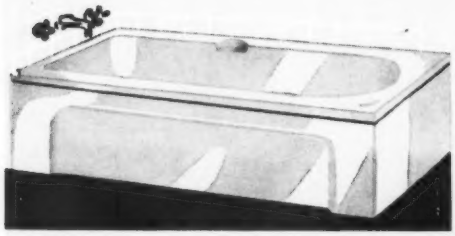

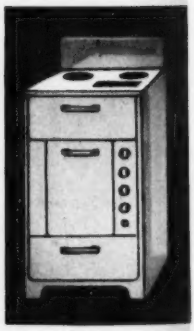

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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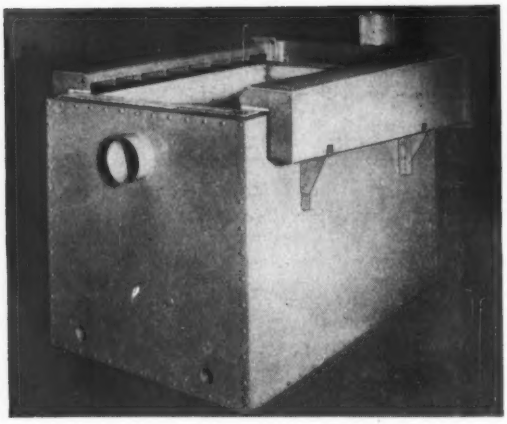

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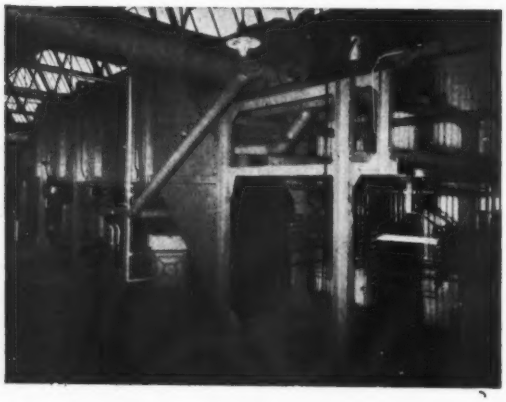

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CORROSION SCIENCE

THE reaction of certain chemical elements and compounds with oxygen, present in the earth's atmosphere, supplies almost the whole of the energy required by civilized man and is indeed the fundamental reaction of life itself. The power required for nearly every modern industrial process is derived from the heat liberated during an oxidation reaction. So effective is the affinity of oxygen for other chemical elements that it enters into very nearly every naturally occurring substance.

Certain of these substances, such as wood and stone, can be utilized as structural materials in their native state by virtue of their own inherent strength and other desirable properties. However, in the great majority of cases in order to obtain materials with specific properties — particularly in the case of metals, it is necessary that their bond with oxygen be broken. Indeed a great proportion of the cost of such materials derives from the large amount of energy which has to be expended in order to sever the metal/oxygen bond.

Nor unfortunately is the severing of the bond the end of all expense incurred in connexion with the metal/oxygen reaction, for, once obtained in its unoxidized state, the metal surface is always susceptible, except in the case of a few of the more noble metals, to recombination with the omnipresent atmospheric oxygen.

It is in the countering of this ready tendency of the common constructional metals to oxidation that the metal finishing industry and the science of corrosion owe their existence.

It is however, only within very recent times that it has been possible to speak with any accuracy of the existence of corrosion science. Until a few decades ago corrosion or rusting or oxidation (the name chosen depending largely on the point of view of the person concerned) was a generally experienced phenomenon and regarded in much the same light as the weather, i.e. *only moderately predictable in its vagaries, but capable of being warded off by the provision of an adequate number of surface coatings of sufficient impenetrability.*

The change which has been and is being wrought in this state of affairs was well typified recently by the Conversazione and Exhibition organized by the Corrosion Group of the Society of Chemical Industry. This Group is the only body in this country concerning itself with the scientific and technical aspects of corrosion on a broad front, but there is no doubt that it is taking an increasingly serious and effective view of its responsibilities in this connexion. A report of the Exhibition appears elsewhere in this issue and the subjects on show ranged from accounts of fundamental investigations into the causes and mechanisms of specialized aspects of corrosion to commercial processes marketed as a contribution towards minimizing its effects.

It is not uncommon to see a figure quoted as the total annual cost to industry in this country of countering and repairing the ravages of corrosion, although any attempt to establish the accuracy of such a figure would be fraught with difficulty. Nevertheless, what ever may be the cost, corrosion undoubtedly provides the basic raison d'être for several thriving industries, and the stimulus for many learned discussions.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

WHAT'S IN A NAME ?

IN social life it is, or used to be, considered a mark of distinction to have a double-barrelled surname. Whether a hyphen is advantageous or not is still a moot point ; those who have one, dislike to see it omitted, and curiously enough, those who don't, resent having a gratuitous one added. It is therefore with some surprise that one finds in this democratic age an increasing tendency for the double-barrelled name to creep into the technical field. Is it possible that the makers of technical products are endeavouring to give them some kind of meretricious cachet by adopting this type of nomenclature ?

If this apparent trend continues we will find the finishing stores list including things called Aspen Artefact A, and Haverstoke Karsogen, or even with the operatic title Vestrini De Bora. The etymology of such names, which from a brief study of manufacturerers literature will not appear to be particularly far-fetched, is mystifying and apparently quite unconnected with the nature or purpose of the product or the name of their suppliers.

I find it difficult to believe that it is good business to use a cumbersome appelation for a product. Short, simple and easily remembered names are best, but if longer names are to be used they should at any rate be informative or descriptive of the products to which they are attached. Another point is that such names should be easily pronounceable in all parts of the globe — and should not have unfortunate connotations in foreign languages !

STRIPPING FOR PROFIT

IS there room for a firm specializing in the stripping of defective plating in the industry ? This question cropped up in a discussion recently on the difficulties which face large scale manufacturers if, for some reason, they run into plating troubles. Great numbers of valuable components which have to be stripped soon accumulate ; there is nowhere to tackle the job in the works and few outside firms have much in the way of stripping facilities for contract work.

This is really not surprising. When a motor manufacturer for example, puts in a plating plant he is always optimistic about its performance, and is reluctant to spend much money at the same time on stripping facilities. The mere admission that these will be required is an implied criticism that his plant is not so good as it should be. Likewise the plant supplier is reluctant to advocate that his customer should instal anything but rudimentary stripping equipment with a new plant, for obvious reasons.

Yet curious things do happen in plating, and sooner or later occasions arise when there is more work, nickel and chromium plated, to be stripped, for a period anyhow, than can be comfortably handled. Nickel stripping is a particularly slow job — much slower than plating, nowadays. There are certainly one or two vitreous enamellers who seem to make a reasonable living from reprocessing other people's rejects and it would be very surprising if an outplater who offered a good stripping service did not find himself doing remarkably well.

He might, indeed, " outstrip " his competitors !

PROMPT RESPONSE

LAST October I took the opportunity of commenting on the fact that plastic-lined equipment is generally black or dark in colour, and cited the advantages of having lighter-coloured tanks etc.

It is therefore gratifying to see that an American company is now advertising tumbling barrels lined with orange-coloured plastic. The makers claim that the resilient linings provide " a smooth light-reflecting surface for cleaning and inspection ".

I should no doubt be flattering myself if I assumed that the company concerned had read my humble notes and decided to adopt the suggestion forthwith. If this were indeed the case it would only confirm the old adage that a prophet is not without honour except in his own country !

LOTS MORE ATOMS

A NOTEBOOK for 1958 has been sent to me by a firm of chemical suppliers, and this contains, as is not unusual, a list of atomic weights. What is different about this list, however, is that it is a really complete one and quite up to date. Instead of the classical 92 elements no less than 104 are listed. Apart from the better known ones which have received much publicity such as plutonium and neptunium, there are some curious ones like astatine and technetium.

Chauvinism is also to the fore, and we have americium, francium, and polonium ; I hope that we shall not be reduced to calling some element " britainium " or " anglicium," or that if we do, the element selected will have an existence rather less ephemeral than the few seconds half-life which is all that is granted to these new arrivals on the scene.

Some Thoughts on THE TREATMENT OF SURFACES by ANODIC OXIDATION

By J. M. KAPE, B.Sc., A.R.I.C., L.I.M.*

Introduction

ANODIZING is almost as much an art as it is a science, and the result of an anodic treatment is often of great design value.

In this respect is it of importance to review the various stages of an anodic process very critically in order to be able to produce a finish which will both satisfy the customer, and any other persons who will see the finished surface.

Pre-treatment

It is well known that a great variety of textured surfaces may be produced by roughening, and various polishing techniques (which may be chemical or mechanical or combinations of the two). Thus if a textured surface is to be achieved, it must necessarily be produced in the pre-treatment stage, prior to anodic oxidation.

Texture is not only dependent on chemical or mechanical treatment of a metal or alloy. It also varies with the metallurgical structure of the material, and in the case of aluminium which is primarily dealt with here, this structure depends on the method by which the component has been produced, *i.e.*, forged, cast, rolled or extruded, and the alloying elements the aluminium contains relative to annealing or heat-treatment operations.

The metallurgical conditions of the material will largely determine the quality and type of textured surface produced by chemical treatment. As an example, a piece of sheet material, whether it be patterned, pressed out into a shape, or merely flat (as rolled), may appear lined in one direction, or mottled, after a chemical etch. This is achieved by rolling in one direction (longitudinally) or first in one direction, then at 90 deg. to it (crosswise). Both textures, one striated (longitudinal rolling) and mottled (cross rolling) can be appreciably intensified (and often are, but not deliberately) by rolled-in oxide, oxidized roll lubricants and pieces of metal which cling to the rolls — together referred to as " hot mill nap." Another intensifying factor which noticably occurs with NS3 sheet, is the precipitation of alloy constituents which lie in the direction of rolling.

These directional textured effects, which if not controlled, can be a surface finisher's nightmare, are often obtained on poor-quality commercial-purity sheets of aluminium. It is only if carefully controlled that they become useful textural additions.

Other metallurgical effects are usually associated with the appearance of grains, large and small, on chemical pre-treatment. These grains can produce a very pleasing patterned effect, providing that the metallurgist has engineered their production form one batch of material to another, and provided that the grains are uniformily distributed over the surface of the alloy. If, as is often the case with heat-treated H30 extruded sections, the grains appear along certain parts of the component only, and have a great size variation (the " peripheral band "), the surface finisher is once again faced with a very difficult problem.

Anodizing

Having produced the required textured surface on the material, the next stage is the anodic treatment, and it is mainly here that the most interesting and contrasting surface effects can be achieved. It must be first realized however, that the various anodic treatments to be discussed can also cause subtle changes in the property of texture previously produced.

The most marked effect of an anodic treatment upon a textured surface is colour, produced with or without opacity. The colour of the anodic film depends both on the alloy being processed, and on the anodic process, relative to the electrolyte type and the way it is being used. The opacity of the coating is partially dependent on the pre-treatment — some chemical etches produce milky white surfaces, some give silvery surfaces —

*Chief Chemist, Alumilite and Alzak Ltd.

as distinct from the brightness of polished metal — and also on the electrolyte type, and thickness of the anodic film. Naturally if the anodic film is coloured the opacity will also be greater.

It is proposed in this dissertation to consider six different electrolytes, only two of which are popularly used in this country. These six are :—

1. Sulphuric acid.
2. Chromic acid.
3. Oxalic acid.
4. Malonic acid.
5. Sulphamic acid.
6. Sulphosalicylic acid.

Sulphuric acid and chromic acid are widely used and both undoubtably achieve popularity because of their cheapness, and ease of operation. Oxalic acid is not utilized to any extent in this country and reasons for this are extremely vague. Some anodizers appear to regard oxalic acid as " taboo," rather as if some curse or spell had been laid prohibiting its use. Malonic acid is a comparatively recent addition[1], Sulphamic acid made a debut approximately thirteen years ago[2], and sulphosalicylic acid appears to be novel unless the sentence

> " Aqueous solutions of sulphonic acids of an aromatic nature are employed which contain hydroxy, oxy and/or carboxy groups in the aromatic hydrocarbon residue . . ."

in certain early patent literature[3], imply its use.

Sulphuric acid is well known, producing a transparent anodic film on commercially pure alloys, and finishes, having high reflectivity, can be obtained if previously electro- or chemically polished and brightened surfaces are anodized. Thicknesses of anodic film up to 0.0004 in. may be satisfactorily applied with little loss of reflectivity if super-pure aluminium, or magnesium alloys based on it, are used[4]. The use of commercially pure metal (99.5 per cent., 1C) limits the thickness of anodic film to 0.00015 in. maximum unless considerable loss of reflectivity can be tolerated.

The thickening up of anodic films by sulphuric acid on commercially pure materials which have been previously polished mechanically, chemically, or electrolytically, leads to a class of surface which may be characterized as " glossy," as against the thin-film type which is designated " reflective."

Sulphuric Acid

Sulphuric-acid anodizing is recommended in BS 1615 : 1958 as the sole method for producing anodized architectural sections, and a film thickness of 0.001 in. is specified. When this film thickness is achieved on various aluminium alloys a great range of rather dull self-coloured anodic coatings are produced — a full description of these colours would not be very useful, but the range may be roughly described as follows. Alloys containing about 5 to 7 per cent. of silicon, with or without magnesium added to improve the strength, yield a light grey (0.0005 in. coating) to dark grey (0.001 in. coating) colour. Chromium (as added to H20 alloys) may impart a pale yellow shade, but the depth of colour is greatly dependent on the degree of dispersion of the chromium. Manganese, as in N3 or H30, tints the film a light brown, and magnesium silicide, as in heat-treated H10 or H9 gives a light-grey shade ; copper, particularly with nickel, gives a yellow colour, and zinc causes a milky film. While it may be said that most of these colours are insignificant (they are not, with the exception of the 5 to 7 per cent. silicon alloy, very noticeable on 0.0005 in. thick anodized material) it is surprising how much contrast they will afford against pieces of " silver anodized " N4, N5 or N6 alloys. The depth of colour is greatly intensified by roughening the surface either mechanically (by grit or sand blasting) or chemically (by etching).

The sulphuric-acid process is best controlled by current density rather than voltage, if accurate build-up for architectural components is to be achieved. A suitable technique would be as follows :—

Electrolyte —	7 per cent. V/V. H_2SO_4
Current density —	12 to 15 ampères per sq. ft. of anode surface.
Temperature —	18 to 20°C.
Agitation —	by air, vigorous.
Time of treatment —	60 minutes.
Voltage required —	22 to 26 for alloys containing manganese and/or silicon ; 18 to 22 for alloys containing magnesium.

The importance of agitation and good temperature control cannot be overestimated — as local or general overheating in the anodizing bath can lead to subsequent failure of the anodic film due to " chalking or blooming " as described in a recent French publication[5].

Oxalic Acid

The oxalic-acid process is, in the author's opinion, neglected in this country. So far textured surfaces characterized as " reflective," " glossy " and " matt " have been obtained, and if sulphuric-acid anodized these surfaces are coloured silver, brownish or grey. The oxalic-acid process provides a further variable, namely to effectively superimpose upon these shades a pronounced yellow colour, on alloys containing no copper. The yellow colour, which is quite light-fast, is considerably deepened by using a.c. instead of d.c. during anodizing. A suitable thickness of oxalic-acid anodizing for outdoor purposes is 0.0006 in. for

coatings produced using d.c. and probably little more for a.c.

A suitable d.c. process would be :—

Electrolyte —	5 per cent. W/V oxalic acid.
Current density —	18 to 24 ampères per sq. ft. of anode surface.
Temperature —	20 to 23° C.
Agitation —	very vigorous, air.
Time of treatment —	30 to 45 minutes for most alloys, 60 minutes for alloys containing manganese.
Voltage —	60 to 70 (Magnesium containing N4, N5 and N6). 70 to 90 (Silicon and Manganese containing alloys).

Vigorous agitation is of great importance if the oxalic-acid film is to be of uniform colour, and great care must be exercised in the first few minutes while applying the voltage, as the barrier layer forms at a high voltage, which drops as the former is penetrated by the electrolyte, resulting in a surge of current, which can only be controlled by rapidly lowering the voltage.

Chromic Acid

The chromic-acid process is of great importance from a design standpoint, as it produces opaque near-white films on super- and commercial-purity aluminium, and alloys of these materials with magnesium. Unfortunately 0.0004 in. is the maximum anodic-film thickness which can be obtained, and this is only produced readily on super-purity-base materials. Copper causes the film to lose its opacity, and manganese colours it a deep whitish brown. Silicon turns it grey. The opaque film process was developed from an idea by Darrin and Tubbs[6] by Lewsey[7] and was more recently fully investigated by A. W. Brace and R. Peek[8]. The process, as recommended by Brace is as follows :—

Electrolyte —	10 per cent. W/V CrO_3.
Current density —	12 ampères per sq. ft. of anode surface.
Temperature :	53 to 54° C.
Agitation —	Air.
Time of treatment —	30 min.—: 0.0002 in. film thickness. 60 min.-: 0.0003 to 0.000 4in. film thickness.
Voltage —	30.

Other Processes

A thick, opaque, white anodic film may be obtained using the " Ematel " process devised before World War II by Max Schenk[9], but the process is expensive to operate, and the bath is difficult to control analytically. It is however notable that opaque white anodic films up to 0.001 in. can readily be obtained on the alloys previously mentioned for the chromic acid process.

The use of malonic acid was recently investigated by the author, and is of considerable interest particularly in view of the deep-yellow-ochre, and sepia-brown coatings which can be obtained. The process much resembles oxalic d.c., in so far that a higher voltage is required for alloys containing copper, silicon and manganese, and copper containing alloys yield opaque, milky white coatings. A typical method to obtain a coating 0.0005 in. thick on commercially pure aluminium, N4, N5 or N6 alloys would be :—

Electrolyte —	12.5 per cent. W/V Malonic acid.
Current density —	15 ampères per sq. ft. of anode surface.
Temperature —	best at 50 to 55°C. (the electrolyte is operable from 15°C. to 80°C.)
Agitation —	very vigorous air.
Time of treatment —	30 minutes.
Voltage —	100 to 108 (commercially pure A1.)
(raise with care)	90 to 95 (NS4).

It is difficult, unless the voltage available is greater than 120, to obtain coatings thicker than 0.0002 in. on Cu. containing alloys, or 0.0003 to 0.0004 in. on Mn.- or Si.-containing alloys. The opacity afforded by anodizing any alloy in malonic acid is considerable.

The remaining two anodizing processes to be discussed are fairly similar, with the important exception that the sulphosalicylic-acid method seems less prone to cause anodic pitting than the sulphamic-acid process. The latter is more like sulphuric acid in its reaction than the former. Sulphamic-acid anodizing has been investigated and patented by Piontelli[2] in Italy and also investigated by workers in Japan[10]. There are drawbacks in the use of sulphamic acid, and the process seems limited to a few alloys, and the film thickness readily obtained to 0.0005 in. maximum. The current density is at an optimum at about 12 ampères per sq. ft. (d.c.), and higher current densities tend to cause anodic pitting, conjointly with anodic oxidation. Pitting is also pronounced at low temperatures, and in concentrations of electrolyte below 7 to 5 per cent. W/V. The colours of sulphamic coatings are similar, but considerably more intense than those produced in sulphuric acid — it would appear that certain alloy constituents, notably Mg_2Si and iron intermetallic compounds are almost completely insoluble in the electrolyte and cause considerable colouration. As it will be appreciated, the formation of " reflective " coatings using sulphamic acid as the anodizing medium is almost impossible. The Japanese workers claimed that by using a.c.

it was possible to produce coloured coatings — one described as "turtle green" sounds most fascinating. The satisfactory anodic oxidation in sulphamic acid of alloys containing appreciable amounts of copper is in doubt.

A suitable method to obtain 0.0002 to 0.0004 in. coatings using sulphamic acid would be as follows :

Electrolyte —	15 per cent. W/V sulphamic acid.
Current density —	12 ampères per sq. ft. of anode surface.
Temperature —	20 to 30°C.
Agitation —	vigorous air.
Time of treatment —	30 minutes.
Voltage	≏ 30 to ≏ 50 (1C and N4).

Sulphosalicylic acid[11] is a chemical which is closely related to "aspirin", but could not be said to be the remedy for the anodizers' headaches.

The technique of anodizing in sulphosalicylic acid is a matter of some debate, and it would appear that the electrolyte changes in some way with use, particularly if the aqueous solution is used rather hot. Like the malonic and sulphamic electrolytes, the sulphosalicylic electrolyte functions over a wide range of temperature — from 20°C. and below, to 80°C. The voltage required to form the coating is slightly less than that of malonic acid at any one temperature, and the optimum current density seems to be 12 ampères per sq. ft. there being less or no increase in rate of film formation by using a higher current density (d.c.). Like chromic acid the film thickness limit would appear to be 0.0003 to 0.0004 in. on most alloys. High copper alloys may be processed — about 0.0002 in. seems to be the maximum thickness obtainable. The colour of the sulphosalicylic-acid film is whitish grey on both copper- and non-copper-containing alloys, and the coating will accept dye fairly well. The opacity is considerable, therefore "reflective" surfaces are not possible. A tentative method would be :—

Electrolyte —	5 per cent. W/V sulphosalicylic acid.
Current density —	12 ampères per sq. ft. of anode surface.
Temperature —	20 to 80°C. (50°C. is a good working average).
Agitation —	very vigorous — air.
Time of treatment —	30 minutes.
Voltage —	≏ 70 to ≏ 90 (at 54°C.).

Post-treatment

So far it has been shown how, by pre-treatment and anodic treatment a series of surfaces have been produced, which may be summarized as follows :—

1. Reflective.
2. Glossy.
3. Matt.

Six different anodic treatments have been briefly described and any one of these may considerably alter the surface in addition to its property of texture — namely by colouring it, or by opacifying it. By necessity, a 'reflective' surface becomes a 'glossy' surface if opacified, hence 'reflective' surfaces are only produced by sulphuric-acid or oxalic-acid anodizing a brightly polished surface, and it could be argued that oxalic acid ruins a mirror reflectivity by its yellow tint.

If the anodic film is dyed or pigmented a vast range of differently coloured surfaces is introduced which may be superimposed upon the natural colours of the anodic films previously described. There is not room to discuss here the some forty different inorganic colours and several hundred dyestuffs on the market ; and unfortunately only about seven of the dyes and a few of the pigments are light-fast over a long period of time. It should be pointed out however that only the oxalic- and sulphuric-acid anodic films are readily coloured by inorganic pigments, and the films produced by anodizing copper-free alloys in malonic, sulphamic or sulphosalicylic acid are not very readily dyed, owing to their relatively low percentage pore volume.

It is usual to seal an anodic film, and apart from the more usual aqueous solutions (including the chromate seal, which imparts a yellow colour) the film may be treated with certain organic oils and waxes ; *i.e.*, silicone, motor oil, carnauba wax or beeswax, lanoline, etc., which enhance the gloss.

Discussion

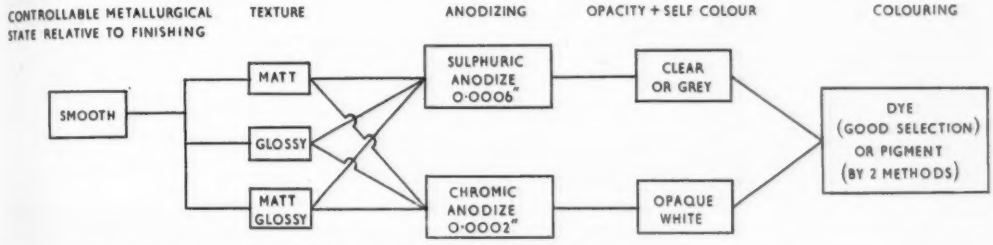
It will be appreciated from the preceding statements, that a great deal of the responsibility for the production of aluminium and aluminium alloys which are uniform in texture from batch to batch after the surface finishers' treatments, rests with the metallurgist. It rests primarily with the metallurgist to roll sheet and extrude metal, etc., which is capable of being textured uniformly. Once this factor is guaranteed, it is then up to the anodizer to produce the required finish, relative to the performance which is expected of the finished material.

It is not proposed, in this discussion, to deal with finishes for specialist applications — such as high corrosion resistance, electrical insulation, frictional wear, abrasive properties and so on. Rather, the aesthetic properties of the material for indoor and outdoor useage is to be considered.

Assuming that the anodizer has obtained from the metallurgist (a strictly hypothetical approach, admittedly) a material which he knows is capable of being etched to a smooth satin finish ("matt"), he has available in this country at the moment, two methods of anodizing such a material, and numerous ways of dyeing it. He may have also

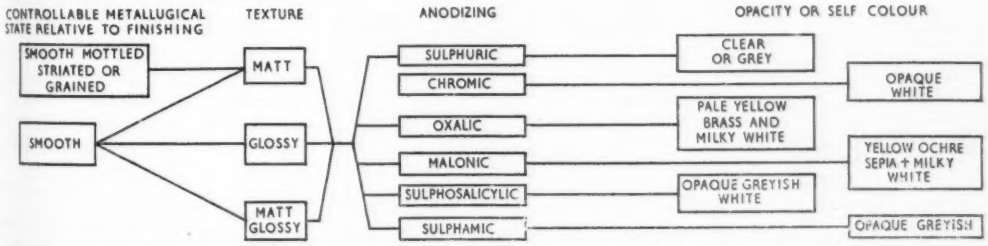
one method of pigmentation, and probably two methods of sealing.

The architect is the next of the " dramatis personae " — and will often demand for an exterior or interior, a finish which may be unobtainable, either because the metallurgist has managed to concoct a material giving the wrong texture, or because the anodiser has not the means of anodising and colouring to the correct shade or for the required durability. If an interior finish is required by the architect then he has the following choice for 1958 :—



For exteriors he is limited to the sulphuric-acid process 0.001 in. film and the same texturing and colouring process as above, and about two yellow dyes, one rather uncertain blue, perhaps one red and two blacks which are light fast. He also has (if lucky) a bronze and an orange shade in pigments, which do not fade appreciably and have been occasionally used.

He could have the following, if the metallurgical state of material for finishing could be guaranteed, and if the oxalic acid process were in extensive use for large components, and the malonic, sulphamic and sulphosalicyclic for small ones :—



The dyeing and pigmenting would be much the same as the first chart with the possible exception that a few pleasing pigments including a brown, yellow, pink, green, and greenish blue, could be added for interiors. The green and greenish blue may also be useful for exteriors.

The " reflective " condition, specified earlier, is becoming less of a specialized finish for reflectors, and is finding its way on to motor cars in lieu of durable nickel-chromium plated finishes. Although the motor-car industry is very conservative in its approach to finishes it is felt there may be call for textured and coloured finishes for motor cars, particularly for interiors, and a few of the more expensive electrolyte processes mentioned — *i.e.* malonic, and sulphosalicylic acid, may have a use here.

Conclusion

The finishing of aluminium by anodic oxidation is capable, as has been seen, of producing a large range of textured and coloured surfaces possessing differing degrees of opacity ranging from non to fully opaque.

Which, of the combination of processes mentioned in the previous discussions, will be used for a particular design application is at present fairly easily seen as the choice of type of finish is relatively restricted.

It is maintained, and it has been the purpose of this article to illustrate, that many more finishes of great design value could be produced if :

1. The metallurgical variables influencing the texture of materials and their reaction to anodizing were studied, and subsequently, therefore accurately controlled.
2. More subtle methods of anodizing, colouring, and sealing were employed.

Appendix

Methods of pre-treatment to obtain various textures.

1. *MATT*

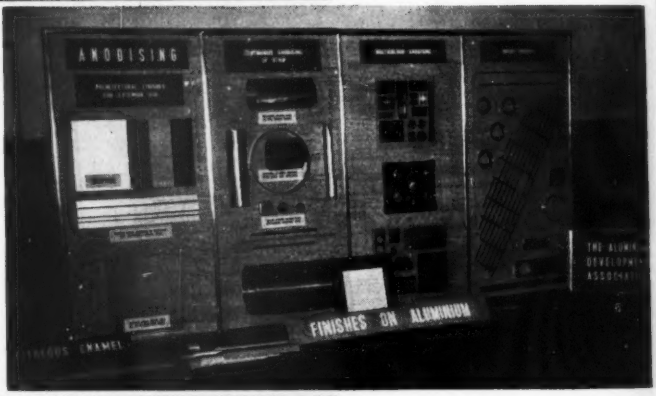
(a) *Silver etch.*

Etch 10 per cent caustic soda, 60°C.,

(*Continued in page 60*)

CORROSION GROUP EXHIBITION

(left) The display set up by Albright and Wilson Ltd. in which were featured the properties and applications of nickel-phosphorous alloy deposited by the Kanigen chemical reduction process.



(right) Displayed by the Aluminium Development Association were samples of various finishes applied to aluminium, including the comparatively recent development of vitreous enamel, both lead-bearing and lead-free.

(left) Sprayed coatings of metal and plastic were shown by the Schori Division of F. W. Berk and Co. Ltd., who also featured the novel peen-plating process; samples of chain and small hardware coated with such metals as zinc, cadmium and brass were exhibited on the stand.

SOCIETY OF CHEMICAL INDUSTRY
Corrosion Group
EXHIBITION AND CONVERSAZIONE

On January 23, the Corrosion Group of the Society of Chemical Industry held once again its evening Conversazione at the Battersea College of Technology.

This function has now established itself in the calendar of events of interest to the specialists in corrosion and metal protection and it was attended by a large and distinguished technical gathering. As in former years a number of firms relating to the subject of corrosion was shown during the evening and considerable interest was focused on the Exhibition, in which over thirty stands sponsored by various technical and commercial organizations displayed different aspects of research and development in the fields of corrosion and protective processes.

The content of these displays, some of which are illustrated, is reviewed in the following pages. The exhibition remained on view during the day following the conversazione and attracted many visitors.

Albright and Wilson Ltd., featured Kanigen plating on their stand. This now well-known system of chemical nickel plating can be used on most metals and on glass, ceramics and thermosetting resins. It is a nickel-phosphorous alloy containing about 8 per cent of phosphorous and it can be applied even to articles of complicated shape. Tests have shown that Kanigen plate has a low porosity and therefore high corrosion resistance, and it is hard and wear resistant, the deposited hardness being about 500 V.P.N. but increasing to 1000 V.P.N. after heat treatment. The " throwing power " of the solution is infinite, and the plate thickness may be controlled to within very fine limits.

On the stand a cast-iron piston plated all over showed how the process reproduces the surface finish of the substrate material. Also shown was the use of Kanigen on titanium. A titanium ram which operated in an aluminium cylinder completed 183,000 reversals fully loaded after being plated. An untreated ram only completed 15 reversals before breakdown.

The process, used on materials such as steel or aluminium, can often replace more expensive materials, and the high uniformity of the coating makes it suitable for plating on precision machine parts. Kanigen plate confers on aluminium a hard surface easily wetted by lead-tin solders.

Of particular interest on the stand of **The Aluminium Development Association** was a selection of flat sheet and strip and formed sections that had been vitreous enamelled both with lead-containing and lead-free frits. The samples were of British (Ferro Enamels Ltd.) and American (The Kawneer Co.) origin. A wide and attractive range of colours was shown and it was noticeable that vitreous-enamelled aluminium can be sheared without the enamel cracking away from the sheared edge.

Multicolour anodizing in the form of name plates, radio dials, etc. etc. was illustrated by a range of products from Alumilite and Alzak Ltd., and the use of anodizing for the production of architectural finishes for exterior use was illustrated by products from Acorn Anodizing Ltd. Samples of continuously anodized strip were also displayed ; these were products of A/S Nordisk Aluminiumindustri.

C. Baker of Holborn Ltd., showed a wide-field binocular microscope and a surface finish interference microscope. In this latter instrument interference microscopy is used with a system based on a modification of that devised by Mirau. The instrument has provision for the visual assessment of an area of the work to be examined rather than the limitation of point contact. The makers claim that with a little practice it is possible to assess a surface to about 1μ-in. at a glance.

The equipment includes a 35-mm. camera for photomicrography. The unit of measurement is the wavelength of the green band of the spectrum and is therefore constant. The light is derived from a mercury lamp. Filters are fitted and controlled by a selector control ; a variable aperture is also fitted for altering the contrast when viewing the specimen.

Differentiation between grooves and ridges in a specimen is easily obtained because the interference fringes generated by the tilt in the optical system run against the tilt of the table when following a groove. The converse applies for a ridge. The instrument can be applied to plane, cylindrical or spherical surfaces with equal facility.

F. W. Berk and Co. Ltd. (Schori Division) showed panels sprayed with various types of

plastics. These included polythene, nylon, Araldite, neoprene, Epikote, thiokol and shellac/mica. Plastic-sprayed samples were also shown in various corrosive media.

A feature on the stand was peen-plating. This relatively new and electroless method can be used for the plating of small hardware with such metals as zinc and brass. Typical objects which can be treated by this method are nails, hose clamps, lock washers, chains, powder metallurgy parts, springs, small stampings etc. In the process the articles are given a suitable pre-treatment, put into a hexagonal tumbling barrel with impacting material, a promoter solution and the coating metal in the form of dust and water. For zinc plating, for example, the barrel is operated for 45 minutes, and the plating efficiency can be as high as 98 per cent. Peen-plated coatings of zinc can be applied to any normal thickness, and the coating can be put on to highly tempered objects such as spring lock washers without danger of hydrogen embrittlement. Sintered powders can be plated without danger of subsequent corrosion from an absorbed electrolyte.

Samples of "Plasteel" a plastic-coated steel sheet developed by **The British Iron and Steel Research Association** were shown on their stand, both as flat sheet and after deep drawing. This material and its method of production has been fully described in *Metal Finishing Journal*.

The prevention of corrosion on buried pipe lines is a problem which has been solved by the Association. Pipes buried for 5 years at Benfleet were shown on the stand with various surface coatings ; these were 1 mil of commercial coal tar, 5 mils of modified coal-tar pitch and 20 mils of slate-filled coal-tar pitch. For comparison an untreated pipe was shown.

The protection of steel by sprayed metal coatings was illustrated by samples which had been exposed in a steel pickling shop, a glue extraction plant, at Battersea and at Sheffield. The samples shown were bare steel, steel coated with 3 mils of sprayed zinc and steel coated with 3 mils of sprayed aluminium. From these samples it appeared that the sprayed zinc coating provided the best protection.

A further set of samples showed the effect of metal coatings for protecting steel in tropical environments. All the samples shown had been exposed for 8½ years at Lagos and were coated with : 3 mils aluminium, zinc chromate in an alkyd medium and flake aluminium in a phenolic medium ; zinc chromate in an alkyd medium and flake aluminium in a phenolic medium ; and 3 mils of aluminium. Bare steel was also shown as a comparison.

The stand of the **University of Cambridge (Metallurgy Department)** illustrated the fact that the protection given by unpigmented paint films is associated with their electrolytic resistance, by means of the experimental results of studies of the changes of resistance of varnish films immersed in solutions of various electrolytes.

W. Canning and Co. Ltd., exhibited a representative range of their products and showed examples of their use. Nickel sulphamate deposition, super Zyntax bright zinc, Kadomax bright cadmium, Hycrome hard chromium, Silvax bright silver and Cuprax cyanide copper were some of the plating processes on show.

Of particular interest was the company's Ohmax plastic coating for electroplating jigs, a typical example of a jig that had been in use for a year in a Ni/Cr plant being on show.

The company can supply jigs built to suit customers' particular requirements and stainless-steel contact points are used throughout. Jigs for use in anodizing can be supplied with titanium contact tips, eliminating the need for stripping after use. Titanium contact tips can also be used on nickel and chrome plating jigs if required.

On the stand of the **Central Electricity Boiler Corrosion Research Laboratory,** a test rig was set up to demonstrate the continuous removal of dissolved oxygen from water, allowing the use of existing resins for the purpose, and without impairing the ion-exchange properties of the resins.

The process was described in detail in the *Journal of Applied Chemistry*, Vol. 7, Part II, November 1957, in a paper by E. C. Potter and G. Whitehead. New types of water treatment are made possible by the combination of ion exchange and deoxygenation in the one resin.

The idea of using ion-exchange resins to remove dissolved oxygen from water is not new. The principle and application of the new method are that the resin supports an insoluble deoxygenating substance precipitated within the pores of the resin matrix. Suitable substances to precipitate in the resin are ferrous or manganous hydroxide, each of which reacts extremely rapidly with oxygen dissolved in water. The resin, whether cationic or anionic, retains its ordinary capacity for ion exchange.

A useful property of the deoxygenating resins demonstrated is their ability to recover efficiency for deoxygenation on standing after the break-through point for dissolved oxygen. The recovery is less the more exhausted the resin, but is greater the longer the standing time.

Although resins carrying ferrous or manganous hydroxide have been tested primarily for the removal of dissolved oxygen from water and aqueous solutions, their use should be possible with any substance capable of oxidizing ferrous (or manganous) hydroxide.

From the columns exhibited, solutions containing

Among the wide range of their products displayed by W. Canning and Co. Ltd., their plastic jig coating, Ohmax, was particularly featured.

less than 0.001 parts per million of dissolved oxygen are readily obtainable.

Five separate exhibits illustrated the **Chemical Research Laboratory's** corrosion researches. These were : the use of radioactive tracers in studying the mechanism of corrosion inhibition, illustrated by the results of experiments in which steel was immersed in solutions of potassium chromate " labelled " with Cr^{51} ; the behaviour of some non-ferrous metal coatings in ethylene-glycol anti-freeze solutions containing corrosion inhibitors, illustrated by test results ; results of recent research on the addition of sodium benzoate and sodium nitrite to ethylene glycol anti-freeze solution as a means of preventing corrosion ; results of tests on the corrosion of mild-steel tubes in a laboratory simulation of a Scotch marine boiler ; and an apparatus for assessing the absorptive capacity of reagents used to absorb hydrogen sulphide in tarnish-preventive wrappings for silver and copper.

Many compounds are known which, when present in sufficient concentration in an aqueous solution, will prevent the corrosion of certain metals immersed in the solution. The best known of such corrosion inhibitors are the chromates of alkali metals. Although much research has been carried out in many laboratories over many years, the precise mechanism by which chromates and other inhibitors prevent corrosion is still not fully understood.

In recent years, a very powerful tool, in the form of radioactive isotopes of many chemical elements, has become available for the estimation of small traces of these elements. Advantage is being taken of this technique at C.R.L. to study the mechanism of action of the chromates, using potassium chromate labelled with radioactive Cr^{51} (half life 27.8 days, emitting gamma radiation).

Mild steel specimens are cleaned with emery cloth and degreased, then immersed in solutions of labelled chromate for known periods. After removal from the solution, they are washed and dried, and the radioactivity on the surface is measured with a Geiger-Müller counter. Comparison with the count given by a standard chromate enables the amount of Cr on the surface to be calculated.

The uptake of Cr by the metal surface has been studied in relation to various factors such as :

time of immersion ;
time of pre-exposure to air, before immersion ;
*p*H and concentration of solution ;
the effects of dissolved oxygen ;
the temperature of the solution ;
the surface roughness of the steel ;

It has been found that the amount of Cr taken up by the surface bears a linear relationship to the logarithm of time of immersion, and that film growth in solution is analogous to oxide film growth in air. This film growth is preceded by rapid adsorption of a Cr-containing film.

Following on this, it has been found that the " logarithmic " film growth in chromate is preceded by the very rapid uptake of an amount of Cr that is roughly constant irrespective of the age of the surface oxide film. This represents a film of the order of a monolayer in thickness, probably chemisorbed.

It has also been shown that the presence of oxygen in the chromate solution diminishes the rate of Cr uptake and hence, presumably of direct oxidation by chromate. This effect has not been suspected or taken into account in previous theories of passivity. It is assumed that the roles of chromate and oxygen as oxidizing agents are complementary, even though the concentration of oxygen is much smaller than that of the chromate ions. Chemical analysis of the stripped films is being carried out to check this hypothesis.

In summary, it may be stated that mild steel in

chromate solutions acquires an adsorbed film immediately on immersion. This stage is followed by progressive film growth with an adsorbed film always present. The degree of protection (as shown by electrode potential decay curves) increases with increased film growth.

It can also be stated that film growth in air and in chromate solutions follows the same laws and is believed to be analogous in mechanism.

The Cromford Colour Co. Ltd. showed a modification of the C.R.L. method for the evaluation, by electrical capacitance measurement, of painted panels immersed in sea water.

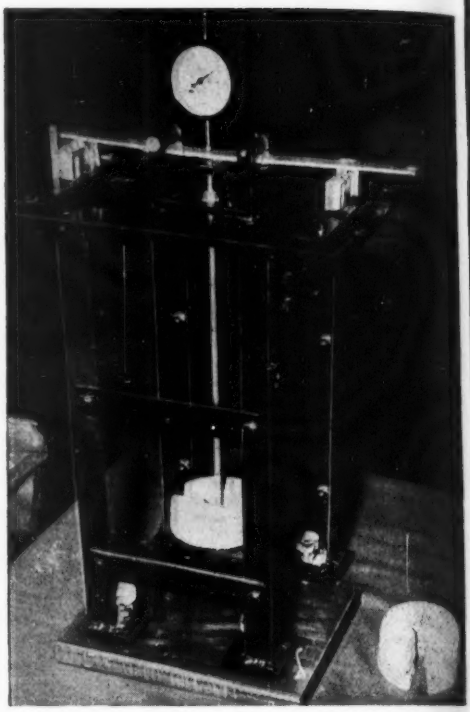
Over the last few years a number of pigments has been examined for suitability for use in wash primers of the two-pack type. In general, zinc tetroxychromate, the pigment originally used was found to be rather better than the other pigments tested, but an exception was a mixture of zinc oxide and zinc potassium chromate, which was superior to zinc tetroxychromate. The use of this mixture was suggested by bench work on the changes which take place after the two packs are mixed. The results of laboratory and exposure tests of work on the above subject were also shown on the stand.

Dawe Instruments Ltd. showed their portable ultrasonic cleaning equipment for relatively small components. This equipment comprises a generator which provides power at 38 kc/s suitable for transducers having a total area of 30 to 40 sq. in. This area is sufficient for a tank of 1-gal. capacity or two tanks of ½-gal capacity each. These tanks have the transducers built into the base. As an alternative, standard transducers, 2⅜ in. x 8 in. x 3 in. high, are available to convert existing cleaning tanks for ultrasonic cleaning at a minimum cost. Two of these transducers can be driven by one generator. If necessary several generators can be operated in parallel to supply larger power outputs. All existing cleaning media can be used and organic solvents, detergents, alkaline solutions and mild acids can all be employed with the standard transducers. Ultrasonic cleaning is a rapid process and by mechanizing the feed of parts into and out of the bath, ultrasonic equipment is easily incorporated into production lines.

Detel Products Ltd., had on show a simple rig to demonstrate the heat-resisting aluminium paint they manufacture.

A test panel coated with the paint was maintained at a heat of 500° C. by a bunsen burner. Above the plate, a cock was arranged to drip water onto the back of the heated surface. The rig was designed to simulate the effect of rain on a flue carrying hot gases.

On a stand occupied by **Fibreglass Ltd.** the applications of the firm's materials as a reinforcement of protective coatings were illustrated.



A simple non-destructive method of assessing corrosion damage was demonstrated by the Fulmer Research Institute in the rig shown here

Samples of plastic coatings and reinforced plastic corrosion-resistant materials were also shown.

On the stand of the **Forestal Land, Timber and Railways Co. Ltd.,** developments in the use of tannins as anti-corrosive agents in paints were illustrated by examples of primers containing tannins and of experimental paints made with corrosion inhibitive pigments formed by the reaction of various metals with tannins.

One feature that has stimulated interest in the use of tannins as anti-corrosives has been the recovery, from archaeological sites containing highly corrosive soils, of metallic objects in a remarkably good state of preservation. It has been found that on these occasions tannins have been present in association with the preserved objects.

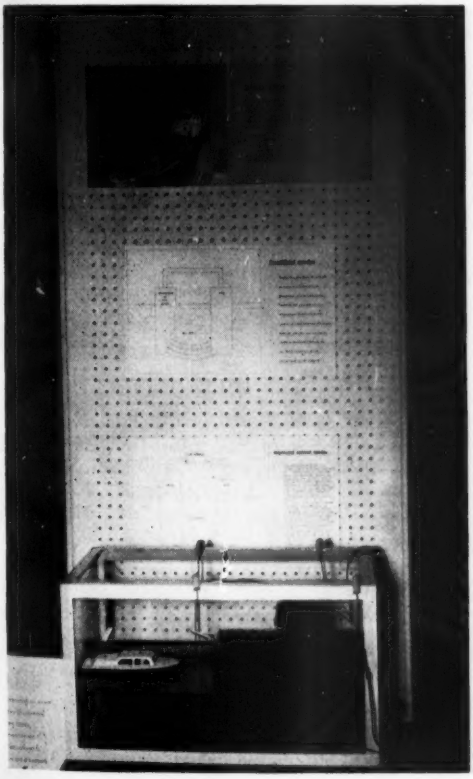
The exhibits showed tannin applied as an aqueous wash to metal prior to painting. The wash had reacted with iron or steel to form a film of blue-black iron tannate which under paint would give a degree of protection similar to that afforded by phosphate treatment. The tannin wash has the advantage of being non-toxic and non-aggressive. The tannin primer was brush applied.

Of particular interest in offering the possibility of low-cost, long-term protection of freshly made plate, was a tannin-latex product having a life of several months. The protective ability of iron tannate formed when these materials are applied to steel enhances the capacity of the latex to lay down a sealing film. The system is particularly effective when applied over millscale.

These two systems depend for their effective action on the development of iron tannate *in situ* on the surface of the metal treated. Shown on the stand was a range of pigments manufactured from pre-formed metal tannates for use in anti-corrosive paints. Incorporated into conventional paint systems, the pigments endow the coating with good anti-corrosive properties. Research work on this subject is now going on.

On the stand of the **Fulmer Research Institute** a range of samples showed the suitability of electro-galvanized steel as a basis for paint. The samples, which were exposed at Hayling Island and Sheffield included plain steel, phosphated steel and electro-galvanized and phosphated steel. Sprayed metal coatings were also illustrated.

A model steel pier illustrating the use of composite titanium-platinum anodes for cathodic protection of such structures was one of the features of a comprehensive exhibit staged by Imperial Chemical Industries Ltd. setting out the properties and application of titanium.



The Institute have developed a non-destructive test for assessing corrosion damage, and the apparatus for this test was exhibited. If corrosion damage is appreciable and fairly uniformly distributed it can be measured by a simple deflection technique. Strip specimens are elastically deflected under 4-point loading conditions and the effective loss of thickness is calculated from the change in apparent bending modulus.

The stand of **Houseman and Thompson Ltd.** illustrated the benefits of water treatment in preventing corrosion. The exhibits were related to the company's D.M. filming amines which are used to protect condensate return systems and also to the addition of tannins to boiler water or to engine-cooling water. Filming amines which prevent carbon dioxide corrosion, oxide deposit, and oxygen pitting, are highly surface active and function by forming a corrosion-resistant coating on the condensate-wetted surfaces. Applied to a boiler or steam line the amines are volatilized and distributed throughout the system. Condensing with the steam they are carried along with the condensed water and plate out as non-wettable films on steam jackets, coils, fittings and lines. Protection is given over a *p*H range of 4.0 to 8.5 and the film formed is of only molecular thickness and once formed requires a reserve of the order of only a few parts per million of active material in the condensate to keep it in repair.

On the stand of **Imperial Chemical Industries Ltd.**, was a model of a steel pier to illustrate the use of composite titanium-platinum anodes in cathodic protection applications.

The anodes used an impressed current. The pier was protected by attaching a negative lead of a d.c. source to the structure, and the positive lead to the anode. The titanium itself was immediately protected, and the platinum acted as the sole conductor of current. Coatings as little as 5 millionths of an in. of platinum have been found to be sufficient for the purpose. Advantages claimed for the composite anodes over the more conventional types are a reduction in weight, better mechanical properties, and, because of the higher current densities possible, a reduction in size.

By adopting the method of anodic polarization, titanium can be used in some special environments where it would otherwise become corroded. The results of tests were shown together with the method of assessing the potential at which corrosion is least.

The protective film formed by the anodic process resists the passage of current to an electrolyte but conducts current to another metal in contact with it. The practical exploitation of this property was demonstrated by the composite titanium-platinum anodes.

The range of metal-treatment processes shown on the **Jenolite Ltd.,** stand included crystalline phosphate coatings as bases for paint or oil finishes, amorphous phosphate coatings applied by cold immersion or by brush as a pretreatment for painting, treatment for steel reinforcement for concrete, a plasticized coating for pretreatment of steel for painting, and a decorative protective treatment for aluminium. Specimens on view included a section of mild-steel rod previously treated with Jenolite CS.3 which had been embedded for some time in concrete. The surface of the exposed metal showed no sign of corrosion, although a section of the same rod which had been left untreated was badly pitted.

The corrosion of steel inclusions in concrete is a critical problem for two reasons : first, because the reinforcement provides about nine-tenths of the ultimate strength of the structure, and second, because renovation of the steel is often impossible after it has been included in the mix. Because rust occupies an area five times that of the metal it replaces, the concrete is forced away from the reinforcement by an ever-growing parting layer of corrosion products.

The company also had on view test specimens to illustrate the properties of a new phosphating process introduced recently. Called Jenolizing B.4, the process gives protection to parts in storage for periods up to several months, and provides an excellent paint bonding surface. The specimens showed that on bright or polished metallic surfaces, the B.4 coating exhibits an array of spectral interference colours ; on pickled or mechanically roughened steel surfaces the coating has a matt blue or blue-grey appearance. The thickness of the coating is estimated to be between 5 and 15 millionths of an inch, while the optimum coating weight for steel in preparation for organic finishes is in the range of 25 to 75 mg. per sq. ft. of surface.

The solution can be used in mild steel dipping tanks or in fully automatic spray installations, and is applied unheated.

Practice and current research with sprayed metal and plastic coatings were illustrated on the stand of **Metallization Ltd.,** by examples of coatings in use and under development. Included were test panels of sprayed zinc, aluminium and duplex coatings of both metals after atmospheric exposure, of painted sprayed zinc and aluminium in sea-water, and of sprayed zinc and aluminium in river water.

The preparation of detached coatings for research purposes was illustrated and some special applications of sprayed coatings, for example, heat resistance and resistance to wear and corrosion, were also shown.

Two of the wire pistols manufactured by the company were shown, together with test panels having sprayed surfaces of zinc, aluminium, nickel, tin and lead. Other panels had been sprayed with a calcium coating using argon gas as a propellent and a high-frequency induction coil for melting the metal wire.

On show, too, were 4 specimens of metal forgings to illustrate the stages in the application of "Colmonoy" hard-facing alloys. The bars showed the preparation, the sprayed surface, and the fuzed and ground finish obtainable with the process.

A series of panels depicted mild-steel plate cathodically protected by foils of sprayed aluminium as a protective coating for industrial environments. The twelve panels had been immersed in a 2 per cent sodium-chloride solution for a number of years.

Nylon, polythene, and Memsene coatings on mild steel were tested for pinholes with an electrical instrument that discharged a stream of sparks to the mild steel if the insulation provided by the coating was broken. The system is used in the company's works to test applied coatings.

Metallic Surfaces Research Laboratories Ltd., provide a consulting and research service to industry on problems related to corrosion, thermal oxidation and wear of metallic surfaces. The emphasis is placed on metallic coatings produced by non-electrolytic methods such as carburizing, nitriding, diffusion of chromium, silicon, aluminium, zinc and other metals. Research directors of the Laboratories, R. L. Samuel and N. A. Lockington, were pioneers of the chromizing process in this country and this process was featured on the stand. A subsidiary company Alloy Surfaces Ltd. have complete facilities at their works for chromizing (effected under the name of Arkrom) and the other diffusion processes. On the stand were representative chromized components such as washing-machine pumps, glass moulds, etc. Other uses for the process include gas-cooker frets, heat-exchanger baffles, paraffin-stove and space-heater parts etc.

Metrotect Ltd. exhibited test-plates to show the make-up of a pipe line coating with plasticized coal-tar reinforced with inner and outer glass wrappings.

On the stand of the **Ministry of Supply** (**A.R.D.E.**) an interesting exhibit was the Drewitt Coating Thickness Gauge which is applicable to coatings softer than the metal base. Shown in co-operation with F. E. Drewitt and D. W. Smith (M.O.S., I.E.M.E.) this instrument contains a prepared dental burr which drills through the coating to the base material. The thickness of the coating is recorded on a gauge. An indicator in the form of an electric lamp is possible with non-conducting coatings.

P.T.F.E. dual-purpose coatings were also exhibited ; these protect and also reduce friction. This was illustrated with two metal blocks one coated and one non-coated and placed on an inclined surface. The sample coated with P.T.F.E.

The commercial model of the coating thickness meter devised by the B.N.F.M.R.A. (and described fully in an earlier issue of Metal Finishing Journal) *was exhibited on the stand of Nash and Thompson Ltd.*

had a much smaller resistance to sliding than the uncoated specimen.

The application of chromium-chromate films on brass to give resistance to tarnishing in saline solutions and photographs and micrographs showing the protective value of phosphate coatings were also included in the exhibits.

Nash and Thompson Ltd., showed and demonstrated the B.N.F. Coating Thickness Meter.

This instrument is a robust and easily used meter capable of measuring non-destructively the thickness of electro-deposited coatings irrespective of whether or not the coating or the base metal is magnetic. Up to the present, work has been concentrated on the measurement of nickel platings on steel, brass, and zinc alloys in the range 0.5 - 1.5 x 10^{-3} in. to an accuracy of $\pm$ 15 per cent. The presence of a thin, decorative chromium deposit has no influence on the results, and means have been devised for determining the thickness of a copper undercoat if required. Indications are that the method can be used for the measurement of a wide range of electrodeposits and base metals and possibly also for the sorting of uncoated metals.

The instrument consists of two parts, a probe unit and a sensitive d.c. amplifier incorporating an indicating meter. The probe is essentially a heated copper body on which is machined a hemispherical tip, subsequently electroplated. When the probe is applied to a plated surface thermoelectric voltages are developed due to the juxtaposition of dissimilar metals and the difference in temperature of the various interfaces. The voltage generated between the probe body and the cold base metal, after amplification, is indicated on a meter and bears a simple relationship to the plating thickness which can be determined by comparison with known standards. For most purposes a chromium-tipped probe is used but when a copper undercoat is to be determined a nickel-tipped probe is required in addition. Provision is made on the meter unit for the connexion and control of two probes.

The probe is designed to be applied by hand or through a simple jig with a steady pressure, approximately normal to the surface of the test piece, the minimum workable radius of curvature on concave surfaces being 0.5 in.

Manual application is satisfactory, a pressure of 5 lb. being required. In routine inspection and for highest accuracy a jig and lever system is preferred. A " cold " connexion to the specimen is required to complete the circuit, this being made by the special clip provided or through the base plate of the jig.

Once the instrument has been set up, all that is necessary is to clean the surface of the specimen, make the " cold " connexion, apply the probe and note the reading on the meter scale, which can be calibrated directly in plating thickness.

To set up the instrument two standard specimens, one for each end of the range of plating thickness, are used. The probe is applied to each in turn and the *zero* and *sensitivity* controls of the amplifier adjusted until readings are obtained at predetermined points on the scale. An hourly check should be sufficient to maintain satisfactory accuracy. Two small dry batteries are used in the zero adjusting circuit, each having an expected running life of 3,600 hours.

Detachable scales can be provided for calibration by the customer and one is available ready calibrated for the determination of certain proprietary nickel deposits.

" Round the clock protection " was the theme of the stand of **The Pyrene Co. Ltd.** Samples on show illustrated the results of using Bonderized, Spra-Bonderized and Parco-Lubrized coatings on steel, titanium, aluminium, cadmium, hot-dip galvanized steel etc. The use of the Bonderite process was illustrated by painted strip produced by Coated Strip Ltd., and various blanking and drawing operations effected on this strip. The excellent " key " provided for the paint could be seen from the absence of flaking of the paint coating. Stelvetite, the plastic-coated steel sheet produced by John Summers and Sons Ltd. is also Bonderized and many samples of this material, both as flat sheet and strip and after deep drawing, were exhibited. The use of Bonderite on aluminium

In the display set out by Silvercrown Ltd. were included examples of various components processed in the different proprietary solutions offered by the Company, including examples of the use of Nickelex white bronze as an undercoat for chromium and bright nickel.

strip was also shown. The use of the Bonderite-Bonderlube process as an aid to deep drawing was illustrated by samples, and a leaflet was available describing the company's Pylumin chemical pre-treatment process for aluminium and aluminium alloys.

On the stand of the **Shell Chemical Co. Ltd.,** marine tanker lining plates immersed in a stirred 50/50 mixture of artificial sea water and gasoline were on view to demonstrate the effectiveness of " Epikote " resin-based coatings as a protection against corrosion. There were also test samples of plates that had been immersed in aerated sea-water for a year.

Paints based on these resins possess greatly enhanced toughness, flexibility and adhesion, with a very high resistance to chemicals and moisture.

Literature to describe their range of " Ensis " brand temporary protective petroleum-base materials, designed to prevent the formation of rust, was on the stand of **Shell-Mex and B.P. Ltd.** The materials are grouped in four categories : non-drying oily film protectives ; solvent-deposited protectives forming soft or hard films (certain of these grades possess de-watering properties) ; protectives forming grease-like films of soft or medium consistency ; and engine preservative oils specially designed for the internal protection of engines and certain machines during storage, shipment or periods of laying-up.

The materials are simple to apply, and except for the heating required by one of the compounds, are supplied ready for use.

Another product marketed by this firm which affords a high degree of protection against corrosion is their range of " Alvania " greases. Used in bearings, for example, the greases will prevent corrosion even when quite large quantities of water are present, because of the incorporation of a powerful water-soluble inhibitor.

The greases are manufactured from lithium soap and solvent refined mineral oil, and contain oxidation and corrosion inhibitors. They have a high degree of stability under severe mechanical working.

One of the leading suppliers of electroplating materials is **Silvercrown Ltd.,** who on their stand showed a representative range of components processed in their various solutions.

A bright mild-steel unpolished radio chassis was exhibited after processing in the company's " Supersonic " bright zinc solution followed by passivation, and a similar chassis shown had been bright cadmium plated and passivated. White bronze plating (" Nickelex ") was shown, both by itself and as an undercoat for bright nickel.

Car hub discs illustrated the use of the company's chrome plating solution on " Nickelex."

The Tin Research Institute illustrated the effect of flow brightening of tin coatings that had been electrodeposited matt. The process can be applied to small articles on which thin tin coatings have been deposited, by immersing them in a suitable oil at 250 to 260°C. A recommended flow-brightening bath is composed of 1.75 lb. of shell Peblum Oil A in 1 gal. of Shell Vitrea Oil 79. After immersion the tin coatings are either air cooled rapidly or quenched in Kerosene.

Samples were also shown of bright deposits of tin obtained by the addition of a suitable dispersion of crude wood tar to acid stannous sulphate plating solution, a recommended dispersion agent being sodium n octyl sulphate.

Winn and Coales Ltd. are manufacturers of the " Denso " range of insulating materials for

(*Continued in page* 60)

A Rational Approach to the Surface Treatment of Sheet Iron and Steel Articles*

by B. van der BRUGGEN†

Introduction

As in all other manufacturing processes, it is becoming increasingly necessary, in the preliminary surface treatment of metal components, to be able to attain the main objective — the preparation of a surface suitable for the application of paint or lacquer — by the most economical and rational means and methods, which must, further, be equally suitable for large, medium or small plants. In the following text, an example of a flexible and economical, surface pretreating plant is illustrated by an actual example, with a few introductory remarks on the general requirements to be observed, and the means and methods available.

Operations in Surface Pretreatment

The preliminary treatment of sheet iron and steel articles, intended subsequently to receive a paint or lacquer coating, for protection or decorative purposes, requires, according to the original condition of the surfaces to be pretreated, descaling, rust removal, degreasing, washing, passivating and/or phosphating — to name only the most important and frequently used operations.

Of these, descaling and rust removal, particularly in the case of large sheets or parts, is usually performed by sand-blasting, or pickling, and is normally effected outside the premises of the painting or lacquering plant. Correctly executed, both methods furnish clean and satisfactory keying surfaces which as a rule ensure good adhesion of the paint or lacquer coats. In normal, industrial painting and lacquering practice only the following operations, depending on the nature of the work to be handled will be considered :

Removal of slight rust films ;
Neutralizing of weld seams, etc. ;
Degreasing ;
Washing ;
Passivating or phosphating.

The decision as to which of these processes is actually to be used, depends on :

(a) The nature of the impurities or contaminants to be removed ;
(b) The structure of the particular surface ;
(c) The requirements imposed by the painting or lacquering process to be used.

Surface Structure

Good adhesion of the first coating applied, is essential for its permanence, and thus for the permanence of all the following coats. This adhesion is determined, apart from the suitability and quality of the paint or lacquer to be used, by the surface structure of the material to be protected by the coating.

Even thorough removal of all contamination, such as oil, grease, dust, etc., will not ensure sufficient adhesion, particularly in the case of very smooth surfaces, *e.g.*, double-pickled sheet steel. In such cases, the surface structure requires modifying to obtain greater keying power.

The contrary is the case in the surface treatment of originally rough, working surfaces, for instance, grey iron castings. The contamination of the surface is in this case considerably more persistent, since the surface protuberances and pores of such a surface, can hold, in addition to oil and grease, an appreciable quantity of contamination such as rust, or the residues of previous manufacturing treatment, such as the dried and often hardened residues from machining coolants and the pigment of marking-out paints, which have to be removed. In this case, the principal need is for cleansing of the surface, since good paint adhesion (good keying) is almost always assured on a rough and porous surface, provided it is sufficiently clean.

Thus, depending on the character of the surface of the work-piece, one or the other of the following pretreatment techniques, will need to be applied :

1. Surface cleansing ; or,
2. Modification of the surface structure ; *i.e.*, improved keying power, or protection against rust penetration.

Surface cleansing

In the cleansing of surfaces, particularly of iron and steel surfaces, it will be possible, depending on the nature of the contaminations to be removed,

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†*Consulting Engineer.*

to concentrate either on degreasing, or on washing, of the surfaces. In the general case, the surfaces arriving at the painting plant, are either oily or greasy, or, and simultaneously, more or less heavily contaminated with factory dust (from sanding, grinding, intermediate stockpiling, etc.). Usually, therefore, it is necessary to proceed, both with saponification or solution of the adhering oil or grease, and with removal of the adhering solid contaminations, by washing or the like.

Disregarding the expensive process of cleaning-off by hand, the necessary cleaning process or processes will consequently have to possess both a sufficient degreasing and a sufficient dirt-removing effect, if the still so often necessary, tedious after-cleansing of otherwise well-degreased, but still heavily contaminated, surfaces, is to be avoided.

The use of water-soluble, alkaline, slightly acid, or emulsion-type, liquid cleansers, would appear to be best adapted to the degreasing and simultaneous mechanical cleansing requirements of most painting and lacquering plants, provided that the means and methods are also best adapted to plant conditions, and a sufficient washing as well as solution action, are assured.

In contradistinction to the high-volatile grease solvents such as tri- or per-chlorethylene, and some other organic solvents, the specific gravity whereof is, moreover, much lower, and the respiratory effects consequently more serious, the water-soluble cleansers will be found by far preferable for open-circuit installations, while the evaporation loss and risk, is slight. To summarize : the means, the methods, and the quipment, for surface cleansing, should ensure a good washing or scouring action, as well as efficient grease removal.

Modification of the Surface Structure

No less numerous than the means and methods for the removal of grease and dirt, are those to be applied for modifying the surface structure of the material to be cleaned. In sand-blasting, rust-removal and grinding, this modification is obtained simultaneously with the cleansing action, and produces heavily, and often irregularly roughened surfaces, which in some manufacturing industries may be found undesirable, as increasing both the labour and time of the subsequent painting or lacquering treatment, when perfectly smooth finishes are required.

At the present time, the preferred undercoating for paint or lacquer on iron and steel surfaces, is a chemically-produced, fine-grained and uniform, surface finish (roughening, passivating, phosphating), there being many intermediate stages possible, between light etching or passivating with phosphoric-acid solutions, and the production of the relatively thick films of the phosphating processes proper. With very few exceptions, requiring the heaviest protection against subsurface rusting, and in which the work is often only black-finished and oiled, the rapid-action and thin-coating phosphating processes predominate at the present time, a development, which is promoted by the requirements of modern continuous and mass-production methods.

However, the phosphating process, which transforms the surface layer of the treated material into a coating of iron or zinc phosphate, and which in many cases improves the quality of the subsequent paint or lacquer treatment (adhesion, rust protection *i.e.*, longer life), is only fully effective in cases in which the coating can no longer be damaged by subsequent manufacturing operations, preceding the application of the first, second or last paint or lacquer coat. This is usually, if not invariably, the case in the treatment of small parts, *e.g.*, office machinery and equipment. Larger sheet-metal components, exhibiting surface irregularities, weld spots, etc., and on which either ground-coating or fillers have to be used, often experience considerable damage to the phosphate coating, by abrasion and destruction of the coating. Since such damage usually occurs on exposed projections, edges, etc., of the work which are, in subsequent use, exposed to the most wear and tear, the initial phosphating treatment is in such cases of far less value, and its cost becomes disproportionate to the attainable advantages in regard to increased life and endurance.

In manufacturing processes in which such grinding-off or rubbing-down is inevitable, phosphating is frequently abandoned in favour of light surface washing with a phosphoric-acid solution; while the corrosion-protection is more limited, the consequent improvement in the quality of the paint or varnish coating, in particular, of the final, enamel coat, in regard to better adhesion and absence of grinding damage, makes it the more worth while. This trend of development, which has found expression in the number and character of the new phosphating processes which have appeared on the market, and the extended use of the 2- and 3-stage methods in the United States, is the consequence of advanced time and motion research, such as applicable to so many other manufacturing techniques.

The variations in the coating formation, in part accompanied by crystallization phenomena influencing the paint coating, and depending on the nature and characteristics of the foundation material (hardness, surface grain structure), which are associated with all phosphating processes, may introduce elements of uncertainty in the treatment of certain grades of sheet material, unless the work is carefully pretreated — by brushing or the like — which is often a time-wasting and expensive operation.

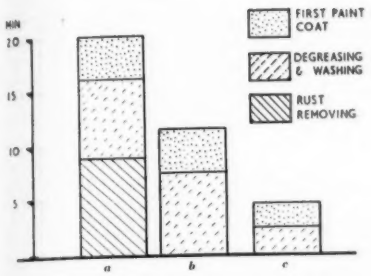


Fig. 1—Comparative treatment times for a large, sheet-iron work-piece. (a) By hand, including rust removal; (b) By hand, without rust removal; (c) By continuous conveyor process.

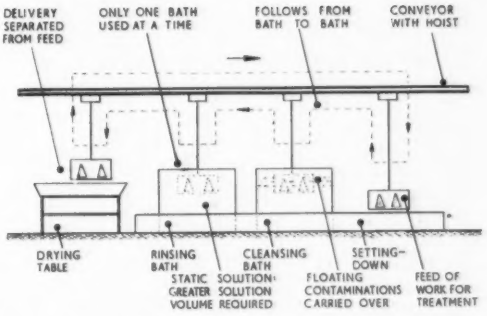


Fig. 2—Dipping-bath installation for degreasing and cleansing metal parts.

Methods, Equipment and Operation

Of equal importance with the selection of correct operational techniques, *i.e.*, those best suited to the degree of contamination and character of the surface to be treated, and appropriate treatment agents (solutions), is their most effective and rational, application and utilization. The decisive factor in this regard, is the selection of the method to be used, and hence, of the equipment required.

Disregarding the essentially degreasing techniques such as dipping or immersion in " trichlor " baths, sprays, or organic solvents, the treatment solution can be applied to the surface, by brushing, dipping, flooding or spraying, using aqueous solutions.

Fig. 1 shows the cleansing times for treating a mild-steel surface, with manual application of the solution by rag or brush, and with mechanical application in a continuous plant with mechanized feed. The low economy of manual cleansing, which is justifiable only in the case of large and bulky work-pieces, is so plainly apparent from the comparison, that the method need not be further considered.

Of the other methods, dipping is the least effective, since it relies exclusively on the chemical action of the bath solution, without any accompanying scouring or removing action on the adhering dirt, by the force of a flowing or moving solution. Hence, handling and holding times are disproportionately long, and manual handling costs high. Flow coating in which the stirring or scouring action of the flowing solution becomes effective, cleans somewhat more quickly than dipping in static solutions, but offers no further advantages.

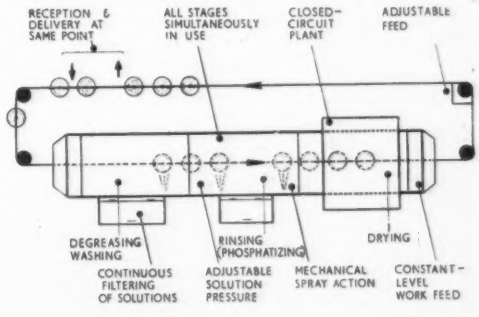
Fig. 2 shows a sectional elevation of a simple dipping installation for cleansing in alkaline solutions, equipped with a straight conveyor track and an electric hoist. The high cost of electric-hoist handling of the material, is also apparent from this diagram. Further disadvantages are the use of static solutions, the large volume of solution in the circuit, introduction of impurities during lifting out, etc. In this form, bath-dipping finds its justification only where single pieces are handled, or, possibly, in the case of very small parts, which can be handled in wire baskets or crates. Where large numbers of identical parts are processed by degreasing, washing, pickling or phosphating, the use of dipping baths, with the consequent repeated hoisting and lowering of the work, brings with it considerably higher expenditure on labour and treatment time.

As against this, continuous treatment in straight-flow installations, such as are already being used in modern plants even for intermittently-occurring, large series and could with advantage be more freely applied in ordinary practice, affords very real advantages in a variety of ways.

Fig. 3 shows as a counterpart to the dipping installation, a straight-flow, metal washing tunnel with a circular conveyor, the construction of which, apart from the fundamental evaluation of output and detail design, can be extensively modified to suit individual needs.

In this case, loading of the conveyor, passing through all treatment stages in succession, is

Fig. 3—Pressure-spray metal-washing tunnel with mechanical closed-circuit conveyor (plan view).



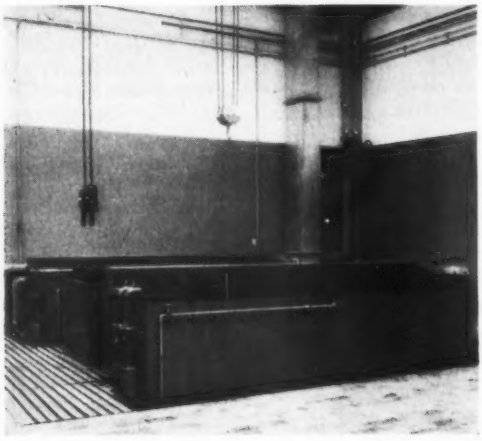


Fig. 4—Dip-derusting plant with suction, heating and air-feed pipes.

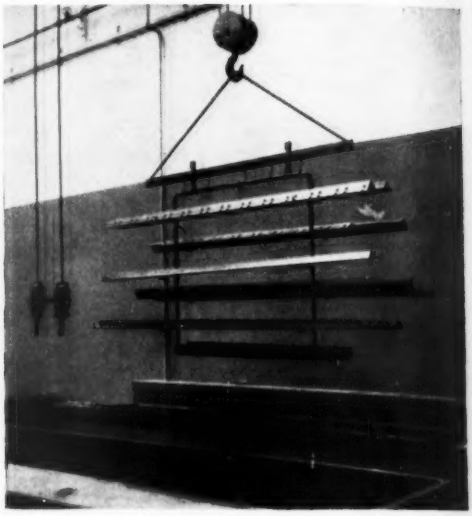


Fig. 5—Work-carrier with work for derusting, on electric hoist.

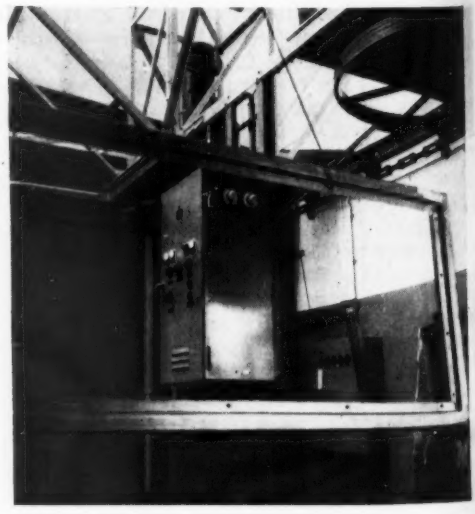
considerably simpler. Respiratory hygiene is much improved, since all working points are totally enclosed in comparison to the conditions in handling hoists over open baths. The pressure-spraying of the cleaning solutions on the work is the only means of obtaining a sufficiently vigorous action, such as is essential for maintaining short treatment times, and such as is unattainable in static or only weakly-agitated solutions.

Figs. 4 to 14 show views of the new paint shop in the Suhr switchboard manufacturing plant of *Sprecher & Schuh, A. G.*, Aarau, Switzerland, in particular, the section devoted to surface pretreatment.

In line with the preceding remarks, this installation is laid out only for the removal of any considerable rusting, by dip-pickling. The unavoidably longer treatment times necessary for the removal of appreciable rust attack by pickling, would be unfavourable to the attainment of the

Fig. 6—Neutralizing flat work.

Fig. 7—Conveyor band with work for treatment and switch cabinet for electronic control.



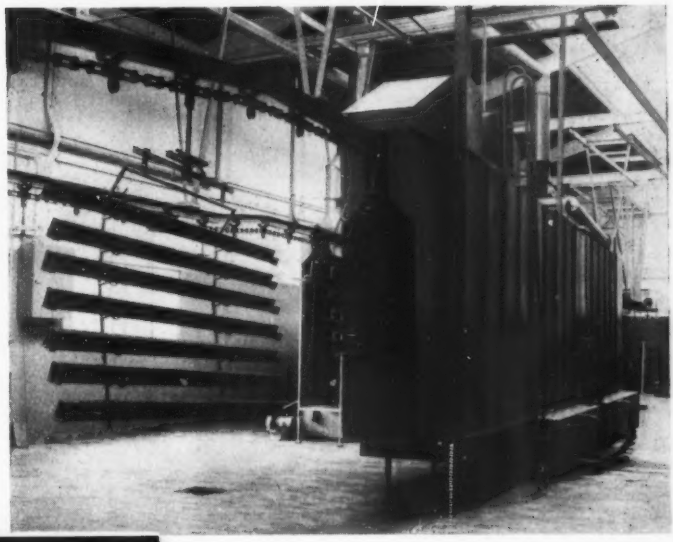
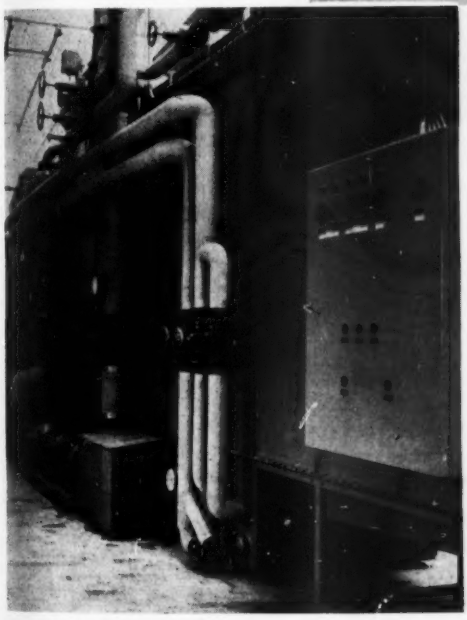


Fig. 8—right. Pressure-spray tunnel for surface pre-treatment with work suspended from overhead conveyor.

Fig. 9—below. Part view of charging side of tunnel with switch cabinet for the tunnel stages.



conveyor speeds required by a fully-continuous method, even if a correspondingly longer tunnel section were to be reserved for prolonged treatment by concentrated acid pickles.

Figs. 4 and 5 show the form and arrangement of this dipping bath equipment for rust removal. The use of unit work carriers and electric hoists with controllable lifting and lowering speeds, greatly assists the work.

Pickling treatment (rust and scale removal) by the dip method, with the associated expenditure on bath charging (hoist operation), is economically justifiable if the alternative of manual-mechanical rust removal would involve longer treatment times and otherwise unsatisfactory effect.

Horizontal, mechanical conveying of the work-pieces has been selected for the pre-treatment of the greater part of the arriving production (removal of light rusting and neutralizing of weld seams and spots). In the continuous tunnel installation, as shown in Figs. 6 to 14, the following considerations have been applied :

Fig. 10 — left. View of a spraying station with solution discharge throttled.

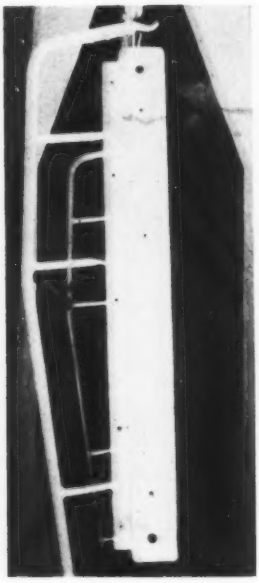
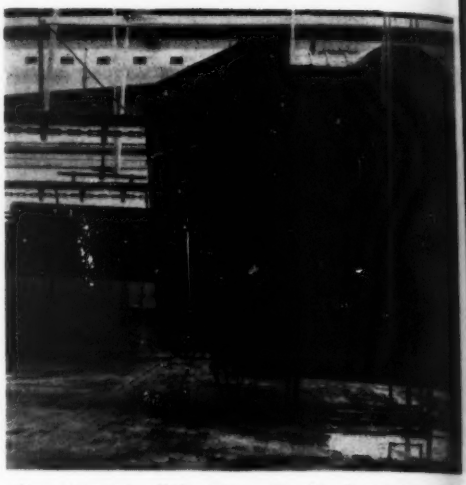


Fig. 11—left. Work-carrier with work piece in avaporating stage.

Fig. 12—right. Treated flat work-piece leaving drying stage.



1. Rationalized handling, by mechanical conveying of all workpieces ;
2. Avoiding moving the work between the individual operations, *i.e.*, execution of the principal process stages in a continuous installation ;
3. Avoiding manual handling of the parts before and after the principal process operations ; *viz.*, execution of all ancillary stages (neutralizing rust and welds, blast-cleaning), on the same conveyor ;
4. Ability to handle pieces differing greatly in size and shape ; special design of the arrangements in the stages for the application of the solutions, air and heat required ;
5. Avoiding the often necessary, after-cleaning of degreased parts : by intensive surface washing, for removing non-greasy dirt and dust particles in the same operation ;
6. Attainment of the shortest possible treatment periods ; by calculating the conveying arrangements with regard for the other operations simultaneously being performed on the same conveyor (paint application, stoving, etc.).

The factors to be considered are :

(a) First cost of the installation (number and length of process stages) ;
(b) Space requirements (layout of the equipment) ;
(c) Power requirements (contemplated air and solution temperatures) ;
(d) Treatment media (nature of solution components : prices).

Items (a) to (d) are of decisive importance for any painting and lacquering installation, since it is often the " gap " between the dipping plants and washers for " static surface treatment ", and the usually extensive, continuous plants for serial and mass production, which makes it difficult for undertakings of only medium size to obtain the benefits of continuous methods.

The continuous tunnel plant shown in the illustrations, had to be designed to fit in to this " gap ", having regard to the quantity of material to be processed and its variety, etc. Nevertheless, despite an exceedingly compact layout, the installation can handle work-pieces up to 1 ft. 8 in. wide, 5 ft. high, and 8 ft. 3 in. long, including flat pieces, small components, a proportion of complete switch cabinets of closed form, and rolled sections.

Certain parts, not readily accessible for spraying or of such a design as to hinder the run-off of the applied solvent, are held in specially-designed carriers, in the appropriate positions.

In addition to degreasing and washing by pressure sprays, provision is made, besides an after-rinse, for the application of a light, ferrous phosphate film (pickling and passivating process). Such " light-weight phosphating " materially improves the adhesion of the following paint coating, and thus facilitates the application of a full coat of paint on vertical surfaces and edges, compared with untreated (unroughened) surfaces, on which the paint can run and form streaks with greater ease.

Surface cleansing can be performed with alkaline or emulsion cleansers, the choice being dictated by the degree of dirtiness of the surface (nature of adhering oil and grease). Suitable additive agents enable the solution temperatures in the treatment stages to be kept so low, that the mean temperature in the plant, does not exceed 65°C. This result is attained by a very careful development of the

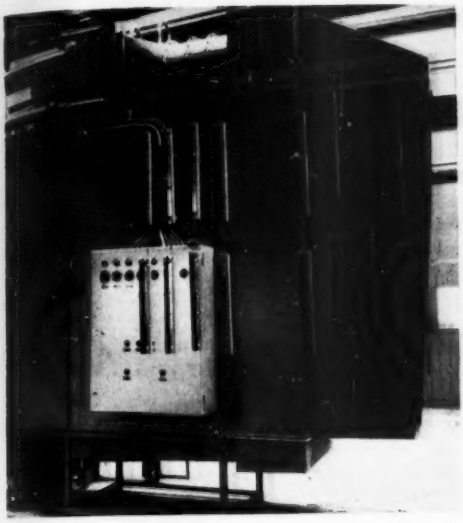


Fig. 13—Work carrier with group of vertically-suspended small components.

Fig. 14—Conveyor section following on precleaning with continuous spraying unit in foreground.

construction of the spraying elements applying the solutions.

The relationship between solution temperature, solution concentration, and spraying efficiency, is particularly noticeable when aqueous solutions are used for the pre-treatment. It is found, that a well-designed spraying station, enables solutions of low temperature and concentration, still to be successfully applied to surfaces which, with less-satisfactory spraying conditions, cannot be effectively cleaned. This also applies, although in lesser degree, to the drying of the parts, which can be appreciably accelerated by more effective application of the drying heat to the surface. Differences in level due to the flowing off of the solvent, must, however, be allowed for.

As will be seen on some of the photographs, the arrangement of the work in relation to the amount of handling required, was also to some extent considered, in that certain treatment products are only handled on specially adapted work carriers, whereby the manual labour of attaching hooks between the work and the conveyor, is eliminated.

The performance of a pressure-spray tunnel for surface pre-treatment, such as shown in the accompanying illustrations, can be quite considerable, if the rate of advance of the conveyor and its degree of loading, are suitably selected. The arrangement promotes the grouping of similar parts, and furthers the application of the paint or lacquer ; it may thus be possible, to treat the daily quota of work arriving, in a half-day washing stage. The continuous charging of the tunnel, which, in a plant of medium size, may only be in operation for a few hours, is justified by the better utilization of the supplied heat attained, as well as of the solutions, heated to their appropriate temperatures. This grouping and pre-conditioning of the work, in a shorter time compared with previous manual handling or dip treatment, is also possible when the tunnel does not form a continuous line with the painting plant, since under normal conditions of room temperature and normal atmospheric humidity, the passivated parts can remain rustfree for several days. Obviously, in protection against corrosion and heat loss. In addition to various examples of lagging for both buried and exposed pipes the company's exhibits included examples of roof trusses protected against chemical and atmospheric attack by a grease-type coating over a paste primer.

Typical of this company's products is Densoset which is a non-setting petroleum-based compound containing silicous fillers. It is waterproof and when applied to a pipe or a truss it forms an impervious seal which protects the compound against corrosion. A tape material is Densyl which is made of highly absorbent tough cotton fabric impregnated and coated on both sides with a compound similar to Densoset. The tape can be applied in straight sections or spiralled on to long straight runs. Densofil is a putty-like material similar to Densoset but contains a large proportion of granulated cork as a filler to give it more body.

(*Continued in page* 60)

S.C.I. Corrosion Group Exhibition

(*Continued from page* 52)

It is readily moulded to any shape, is self supporting and non-setting.

The Yorkshire Copper Works Ltd., devoted their stand to examples of the use of the company's plastic piping for water pipes etc. Various types of plastic were shown and different methods of jointing, both by " welding " and metal connectors shown.

Zinc Development Association. The use of zinc as a protective coating for steel is well-known but its applications and the form in which the zinc is applied to a surface vary greatly depending on the ultimate use etc. On this stand were samples of zinc and cadmium plating in cyanide baths to B.S. 1706, some of the samples also having a chromate passivating treatment. The advantages of galvanizing as a base for paint was illustrated by painted panels, and also panels were shown painted with zinc-rich paints ; these panels were supplied by Secomastic Ltd. Many other uses of zinc including zinc spraying and Sheradizing were also featured. Available on the stand were selections from the Association's " Technical Notes ". These included " Hot Dip Galvanizing," " Electrogalvanizing " and " The Protective Value of Zinc Coating ". Booklets entitled " Zinc Dust in Protective Coatings " and " Directory of Hot-Dip Galvanizers " were also available.

Treatment of Surfaces by Anodic Oxidation

(*Continued from page* 43)

rinse and desmudge in nitric acid. 3 minutes — semi-matt; 10 minutes — matt.

(b) *White etch.*
5 per cent. HF, (40 per cent commercial acid diluted), at room temperature 2 to 5 minutes.

2. *REFLECTIVE AND GLOSSY.*
   (a) *Chemical polish* — Typical solution.
   60 parts by volume — H_3PO_4 (s.g. 1.75).
   20 parts by volume — H_2SO_4 (s.g. 1.84).
   15 parts by volume — HNO_3 (s.g. 1.42).
   100°C. 1 to 3 minutes immersion.
   + a few crystals of urea (minimizes evolution of NO_2 gas).
   (b) *Electropolish* — proprietary patented solutions *i.e.* " Brytal," " Alzak," etc.
   (c) *Mechanical polish* (may or may not precede a and b).
3. *INTERMEDIATE MATT-GLOSSY.*
   (a) *Bright etch.*
   25 per cent. V/V. H_2SO_4 (s.g. 1.84).
   75 per cent. V/V. H_3PO_4 (s.g. 1.75).
   (60°C.). (1 - 3′).
4. *MISCELLANEOUS MECHANICAL FINISHES.*
   Grit and sand blasting, (castings mainly), linishing (extrusions mainly), scurfing, shot peening, scratch brushing (mainly sheet).

Acknowledgment is made to the Directors of Alumilite and Alzak Ltd. for permission to publish this article.

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A Rational Approach to Surface Treatment

(*Continued from page* 59)

any plant, the duration of operation of such an installation, will depend on the volume of work to be handled ; but it can be maintained, that an advantage will be gained, even if the installation is not required to work full days, since the labour rendered redundant, can, under present-day conditions, almost always be profitably diverted.

The " profitability " of the installation is consequently dependent on the number of hours per day saved in the plant as a whole, and thus available for other process stages.

The economy ultimately resulting from the saving in time and power costs, materials (solutions), and labour, will further depend, particularly in the case of establishments of medium size, on the suitability of the particular installation for its particular purpose in the undertaking. There must be a close relationship between the size of the installation and the volume of work to be done, if the benefits of the pressure-spraying technique and the closed-circuit conveyor are to be associated in a manner advantageous for a medium-sized, industrial undertaking.

There are many cases in which neither the use of a pressure-spray washer for " static " solution treatment, nor the installation of a long, continuous process tunnel, can be recommended as the most rational solution. This gap, can usefully be filled by the pressure-spraying tunnel of medium size, with overhead conveyor, the form of construction and flexibility of which are best adapted to the varying needs of the medium-size factory.

FINISHING

NEWS REVIEW

LONDON SYMPOSIUM ON VEHICLE CORROSION

Society of Chemical Industry to Discuss Protection Methods

THE Corrosion Group of the Society of Chemical Industry is to hold a Symposium on the Protection of Motor Vehicles from Corrosion on March 11 and 12 at the Institute of Mechanical Engineers, 2, Birdcage Walk, London, S.W.1., commencing at 9.30 a.m. on each day.

Preprints of Papers

Preprints of the papers to be presented will be available before the meeting to those registering as participants in the symposium and paying the conference fee of 10s. for members of the Society (40s. for non-members).

The papers and a full report of the discussion will be published in due course as a monograph. The availability of preprints will enable the papers to be presented briefly, leaving time for a full discussion.

Contributors to the discussion will be supplied at the meeting, after they have spoken, with a form on which to record the essentials of their remarks. Written contributions to the discussion will be welcome.

Symposium Dinner

A dinner at which the speakers will be entertained will be held at the Connaught Rooms, Great Queen Street, Kingsway, London, W.C.2., on March 11, at 7 for 7.30 p.m. This will be open to all participants in the symposium and their ladies, but accommodation is limited and early application should be made for tickets. Cost will be 30s. a head (including gratuities, but excluding wines).

Dinner jackets will be worn, but visitors from overseas and others whose journeys make this dress inconvenient are welcome to attend informally dressed.

Application for participation in the symposium should be made to the assistant secretary, Society of Chemical Industry, 14, Belgrave Square, London, S.W.1. Closing date for the receipt of registration forms is March 5.

PROGRAMME

March 11

"Corrosion of Cylinders and Moving Parts of Engines," by W. G. Stevenson (*The Motor Industry Research Association*).

"Oil Additives," by N. E. F. Hitchcock (*C. C. Wakefield and Co., Ltd.*).

"Exhaust System Corrosion," by H. Silman (*Electro-Chemical Engineering Co., Ltd.*).

"Corrosion Inhibitors for Ethylene Glycol/Water Coolants for Piston Engines," by A. T. B. P. Squires (*Rolls Royce, Ltd.*).

"Research and Experience with Sodium Benzoate and Sodium Nitrite Mixtures as Corrosion Inhibitors in Engine Coolants," by A. D. Mercer and F. Wormwell (*Chemical Research Laboratory*).

March 12

"Experience with the Land Rover," by S. Heslop and A. Faulkner (*The Rover Co., Ltd.*).

"Experience with Aluminium Alloys in Motor Vehicles," by F. C. Porter (*The Aluminium Development Association*).

"Phosphate Treatment of Vehicles Bodies," by G. Murray (*Pressed Steel Co. Ltd.*).,

"Protection of Electrical Accessories," by A. A. Tomkins (*Joseph Lucas, Ltd.*).

"Packaging of Vehicles and Components for Export," by R. J. Brown (*The Austin Motor Co., Ltd.*).

General Discussion.

Industrial Control Manufacturers' Luncheon

MANY distinguished guests were present at the annual luncheon given by the British Industrial Measuring and Control Apparatus Manufacturers' Association at the Kensington Palace Hotel, London, recently. They included Mr. S. P. Chambers, C.B., C.I.E., senior deputy chairman of Imperial Chemical Industries Ltd., and Mr. T. E. Goldup, president of the Institution of Electrical Engineers.

Speaking at the luncheon, Mr. Chambers said that as firms became larger and amalgamations occurred, the drive for industrial instruments and their better use would go forward. But instruments were of little value unless adequately trained staff were available to install and use them properly.

Mr. E. W. Wilson, chairman of the Association, said that although he would stress that home trade was the basis of export sales, out of a total turnover of £35-million enjoyed by its members, it was expected that exports would exceed £15-million.

Speaking in reply, Mr. Goldup said that accurate measurement and control was the most important factor in industry today, but there was an appalling shortage of technical manpower at all levels. He thought the Hives award would not achieve its objectives unless industry spent time and money on training to match the award course.

FURNITURE FOLLOWS CONVENTIONAL TREND

IF metal furniture is entering the home, it is coming in through the kitchen.

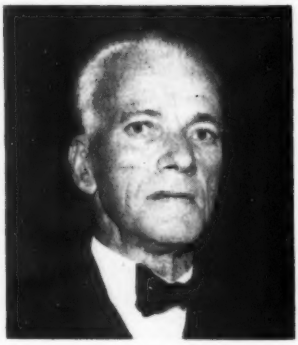
An increasing number of firms had on display at the recent Furniture Exhibition organised by the *Daily Express* at Earls Court, tubular steel dining suites in colours designed to harmonize with the kitchen cabinet and the washing machine. But few manufacturers had taken steel furniture through to the living room.

Perhaps it is in the smaller things for the home that the metal fabricator is making most progress. Anodized aluminium is an attractive material for many household utensils and thin gauge aluminium sheet with stove-enamelled finish is being widely used.

Not yet on view were the "new" materials, plastic coated and decorative mild steel sheets, that hold out so much promise of creating a minor revolution in furniture design, among other things.

Corrosion Expert Retires

MR. W. E. Wright, F.C.S., retired recently from the board of directors of The Pyrene Co. Ltd., and from control of the metal finishing division. Starting some 30 years ago with the original Parkerizing process, he and his colleagues did much to make the British engineering industry "rust-proofing" conscious and under his guidance the Bonderizing range of processes for paint bonding and for facilitating the cold working of metals were most successfully introduced into this country. Mr. H. F. Parshall, M.A., T.D., who has been on the board of the company since 1947, has taken over board responsibility for the metal finishing division.



Mr. W. E. Wright

ADDITIVE FOR TINPLATING SOLUTIONS

THE results of research into the use of wood tar as an additive to tinplating solutions were described recently by Dr. E. S. Hedges, director of the International Tin Research Council, in an address to the Royal Institute of Chemistry.

The addition of small quantities of wood tar to the solution, Dr. Hedges told the meeting, results in a bright finish being given to the tin coating, which, by the normal process, is usually mat.

Experiments are still going on to discover the constituent of the tar which causes this bright finish, but sufficient results have been obtained to show that industrial use of the process is a practical proposition.

Seven commercial firms are using quantities of the additive for trials at their own works. Electrical equipment and instrument parts are among the products which would benefit especially from the new process.

TRAVELLING PAINT SHOW

A travelling exhibition to visit important industrial centres this year is being organized by the paints division of I.C.I. Ltd., Slough, Bucks. A colour film has been especially made for the show.

U.S. Employees' "Service Pins"

FORTY-ONE veteran employees received "service pin" awards recently at a presentation ceremony, held at the plant of The O. Hommel Co., Carnegie, Pa., U.S.A.

Presentation of the pins was made by Mr. Ernest M. Hommel, president of the company. Of all the firms' employees, 62 per cent have 5 years or more service. Sixteen veterans are in the 10 year bracket ; 4 are in the 15 and 25 year category and 2 are "old timers" of 25 and 30 years service, respectively.

A concise review of current company operations and plans for the future, was made by Mr. Hommel during the ceremony. He also reviewed the overall effect of foreign competition and the importance of a competitive price structure.

He placed particular emphasis on the value of employee loyalty in industry, and the importance of employees' suggestions and ideas in improving company production and efficiency.

The company have under construction a new 20,000 sq. ft. research laboratory, scheduled for completion by April 15, this year, when an "open house" will be held for members of the industry attending the American Ceramic Society Convention in Pittsburgh, Pennsylvania.

Future of Trade Fairs in U.K.

Federation of British Industries Holds Enquiry

AN enquiry just completed by the Federation of British Industries into the future of trade fairs in Britain shows that the vast majority of associations are opposed to the development in this country of a general international fair covering a wide range of industrial products, similar to those held in most European countries.

Favoured, instead, is the continued development of fairs covering the products of a particular industry. Some 60 such specialized fairs are already held in this country every year, such as the Farnborough Air Display, the International Motor Show, the Radio Show, etc.

Of 109 trade associations whose members are concerned with trade fairs, some 105 favoured specialised fairs and only 2 showed any decided preference for general fairs. A substantial number indicated that they would like to see the scope of specialised fairs widened sufficiently to allow for the grouping of the products of allied industries.

The enquiry also revealed that opinion was about equally divided, among those trade associations which expressed a view, on the question whether specialized trade fairs in Britain should be national (that is, open only to firms showing products of U.K. origin) or international.

This corresponds with the facts of the present situation. Of the 60 specialized fairs held each year in this country about half are national and the other half international.

Government Request

The F.B.I. enquiry was made in response to a request from the President of the Board of Trade to let him have the opinions held in British industry about future policy on trade fairs in Britain. This arose because the London branch of the British Industries Fair had ceased to operate and the Birmingham Chamber of Commerce had announced that there would be no Birmingham B.I.F. next year, and that it would no longer be responsible for such a fair on the existing all-British basis. It asked the Government to go into the question of organizing an international fair.

The results of the F.B.I. enquiry have been communicated to the President of the Board of Trade and to the Birmingham Chamber of Commerce.

Now that it is known that industry does not want a large general fair (which would require the provision of around 1,000,000 or more sq. ft. of exhibiting space if it were to compare with the great international fairs of Europe) it is possible to consider what is required in order to give specialized fairs the modern and up-to-date exhibition facilities which they need. The F.B.I. now proposes to institute a further enquiry into the problem.

BRITISH COLOUR MAKERS' ASSOCIATION

Election of Officers

THE annual general meeting of the British Colour Makers' Association was held recently, when officers and council for the ensuing year were elected. These are : *chairman:* Mr. V. Watson (Cromford Colour Co. Ltd.) ; *vice-chairman :* Mr. G. E. Hillier (J. W. & T. A. Smith Ltd.) ; *hon. treasurer :* Mr. C. G. A. Cowan (Cowan Bros. (Stratford), Ltd.) ; *council :* Mr. C. M. Beavis (Golden Valley Colours, Ltd.), Mr. A. S. Callaghan (I.C.I. Ltd., Dyestuffs Division), Mr. C. G. A. Cowan (Cowan Bros. (Stratford), Ltd.), Mr. G. E. Hillier (J. W. & T. A. Smith, Ltd.), Mr. H. Gosling (Cornbrook Chemical Co. Ltd.), Mr. J. H. Grimshaw (Horace Cory & Co. Ltd.), Mr. H. Pike (Hull & Liverpool Red Oxide Co. Ltd.), Mr. V. Watson (Cromford Colour Co. Ltd.), Mr. A. H. Whitaker (James Anderson & Co., Colours, Ltd.) ; *secretary :* Mr. Allan J. Holden.

COATING GOES TO SEA

THE biggest modernization job ever undertaken in a British dockyard was completed recently with the commissioning of the aircraft carrier H.M.S. *Victorious*.

Although now 20 years old, the modernization has made her the most advanced craft in the fleet with a fully-angled flight deck, the latest mirror-type landing aids, steam catapults and high speed aircraft lifts.

Contamination of fuel by corrosion particles is a constant hazard in aircraft servicing, and to protect the jet fighters based on *Victorious*, her aviation fuel stowage tanks have been coated with Epinamel A.C., a protective finish made by Arthur Holden and Sons Ltd., Birmingham. The coating is an organic substance that provides a very high degree of protection against corrosion.

H.M.C.S. *Bonaventure*, a Canadian aircraft carrier, and H.M.S. *Centaur* have had their fuel tanks similarly protected, and the Admiralty plan to use this material in other vessels under construction.

AGENCY AGREEMENT

TWO firms, Durham Raw Materials Ltd., 1/4, Great Tower Street, E.C.3. and J. M. Huber, Ltd., 6, Great Winchester Street, E.C.2., have announced that the former have been appointed distributors in the United Kingdom of materials manufactured by the J. M. Huber Corpn., 100 Park Avenue, New York 17.

In addition to their well-known carbon blacks, these include Zeolex (an aluminium silicate reinforcing agent), Turgum S, Butac and Nutac, (rubber resins with specific uses), Actone (an activator-accelerator), and a range of hard clays having no British equivalents.

J. M. Huber Ltd. will implement all orders already received.

MANUFACTURER USES TINPLATE COATED WITH P.V.C.

FOR some time now, a range of vacuum flasks having a decorative plastic finish has been catching the eye of customers in shops all over the world. The flasks are especially noteworthy for the great variety of traditional and contemporary designs in which they are decorated.

The manufacturerers of the flasks, the British Vacuum Flask Co. have revealed recently that they are using a world-exclusive process of manufacture which not only permits constant variation in decoration but adds many inherent advantages to the product.

The process, developed from joint research between the flask manufacturers and the industrial adhesives division of Evode Ltd., Stafford, who make the well-known 'Evo-Stik' 'impact' adhesives, depends upon a continuous line production of tinplate coated with the thinnest printed polyvinyl chloride sheet available.

Although the coated tinplate is subsequently locked over at 180 degrees to form the vertical joint of the flask, neither this operation nor others in the fabrication of the sleeve in any way disturbs the bond between plate and plastic.

It is claimed that an outside surface of P.V.C. has many advantages over the conventionally printed metal. The makers say that printing techniques are better, a greater variety of multi-coloured patterns can be used without incurring high switch-over costs, and the material itself is scuff-resistant, virtually scratch-proof, non-slip and non-staining.

Other advantages are that P.V.C. is very easily cleaned, warm to the touch, and most attractive to look at. When the tin-plate is coated with transluscent P.V.C., the sheen of the metal shows through the coloured coating to give a charming illuminated effect.

Left.—Three of the designs available.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

The Board of Trade have announced the appointment of Mr. Kenneth McGregor, C.M.G., an under secretary in their industries and manufactures department, as the United Kingdom senior trade commissioner and economic adviser to the **High Commissioner in Canada** in succession to Mr. Gordon Bowen, C.M.G., who will return to the headquarters of the Board on completion of his tour of duty.

Mr. McGregor, who was responsible for co-ordinating the arrangements for the recent Canadian trade mission to the United Kingdom, accompanying them during their visit, will take up duty in Ottawa in the summer of 1958. He was formerly in charge of the North American division of the commercial relations and exports department of the board.

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Mr. Ralph D. Parker, vice-president in charge of Canadian operations of **The International Nickel Co. of Canada, Ltd.,** has moved his headquarters from Copper Cliff, Ontario, to the company's offices in Toronto, which have recently moved to larger quarters at 55 Yonge Street.

Messrs. Ralph H. Waddington, James C. Parlee, Richard A. Cabell and Paul Queneau have been elected assistant vice-presidents of The International Nickel Company of Canada, Ltd.

Mr. Waddington has also been appointed general manager of the parent company's Ontario division, and Mr. Parlee general manager of its Manitoba division. Messrs. Cabell and Queneau have been elected also as vice-presidents of The International Nickel Co., Inc., the U.S. subsidiary of the company.

* * *

Mr. R. S. Meggs has been appointed technical sales representative for the instruments division of **Evershed and Vignoles Ltd.,** for south-east England.

Mr. Meggs joined Evershed and Vignoles a year ago, after being with Taylor Short and Mann Ltd., as a research and development engineer. He received his technical education at Faraday House Technical Engineering College and is a graduate member of the I.E.E. He will be assisted by Mr. J. V. Gommersall.

Mr. Gommersall also received his technical education at Faraday House. He served his apprenticeship at Fielding and Platt, and served a two year graduate apprenticeship with B.T.H. Ltd. He is also a graduate member of the I.E.E.

Mr. Jack Weaver has joined **Harshaw Chemicals Ltd.,** Waltham

Mr. J. V. Gommersall

Cross, Herts., as assistant general sales manager. He will continue to reside in Birmingham to cover electro-plating customers in the Midlands. Mr. Weaver has had many years experience in the metal finishing trade in the Birmingham area, from both the technical and sales sides. Mr. R. T. F. McManus will continue as technical service manager.

* * *

Following the completion of the acquisition of the Fletcher Miller Group by C. C. Wakefield and Co., Ltd., the following appointments to the boards of these two companies, and to that of Wakefield-Dick Industrial Oils Ltd., have been announced :—

Mr. R. S. Meggs

C. C. Wakefield & Co. Ltd.—S. R. Miller (chairman, Fletcher Miller Ltd.). **Wakefield-Dick Industrial Oils Ltd.**—A. George (director and secretary, Fletcher Miller Ltd.), R. T. Miller (director, Fletcher Miller Ltd.). **Fletcher Miller Ltd.**—J. C. Cragg (manager, Stanlow Works, C. C. Wakefield & Co. Ltd.). J. W. MacMahon (general manager, industrial lubricants division, Wakefield-Dick Industrial Oils Ltd.). L. J. Windridge (secretary, Wakefield Dick Industrial Oils Ltd.).

* * *

The Ferro Corporation of **Cleveland,** Ohio, U.S.A., parent company of Ferro Enamels Ltd., Wombourn, Wolverhampton, Staffs., announce that Mr. H. T. Marks has been appointed president in succession to the late Mr. Dudley Clawson.

Although born in Canada, Harry Marks received his early education in England at Wallasey, Cheshire, grammar school. He returned to Canada as a young man and joined Ferro through their Canadian associate company. A few years later he transferred to the Headquarters in Cleveland and worked there for some time before being sent to Brazil as the manager of the Ferro plant. Later he returned to Cleveland as manager of the international division, a position he was well qualified for from his earlier experience with the corporation and its foreign subsidiaries. In 1953, he was appointed executive vice-president, a position he held until his new appointment.

Mr. Marks has made several visits to the U.K. and to the Continent in connection with Ferro's international activities, and is well known in the enamelling industry here.

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Mr. S. Teasdale has been appointed by **Martonair Ltd.,** Parkshot, Richmond, Surrey, as technical representative for south Manchester, and an area enclosed by Chester, Crewe and Oldham.

Mr. R. G. Barnes will continue to represent the company in the Sheffield area.

* * *

Mr. F. J. Clark, managing director of the **British Oxygen Group** of companies, has relinquished his appointments with the group after a reorganisation of the management structure of the company.

TECHNICAL BOOKSHELF

Metal Cleaning Bibliographical Abstracts, 1957 Supplement. *ASTM Special Technical Publication 90-D, 44 Pages, $2.00 American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.*

THE abstracts are designed to make the published data on metal cleaning readily available to persons concerned with the production, finishing, and maintenance of metal products. The publication is the work of Mr. Jay C. Harris, Monsanto Chemical Co., who has collected, arranged and indexed the annotated references.

References are arranged by year, then by author or journal. References are numbered consecutively. In addition, the references are indexed by subject, author, specification and patent.

This book contains over 225 new references including cleaning by ultrasonic means ; cleaning stainless steels, and titanium ; and cleaning semi-conductors such as germanium. This book supplements Metal Cleaning Bibliographical Abstracts, STP 90-B, which covers the years 1842 to 1951 ; and the 1954 supplement, STP 90-C, which covers the years 1952 to the end of 1954.

General Galvanising: a manual of good practice. *Hot Dip Galvanizers Association, 34 Berkeley Square, London, W.1. 1957. 54-pp. 25s.*

AS the foreword states, this 54 page booklet is presented as a guide to managers and supervisors in the galvanising industry. The recommendations for good practice have been drawn up by the British Non-Ferrous Metals Association in conjunction with the technical committee of the Hot Dip Galvanisers Association and it is claimed that the book combines the results of research work with the latest practical experiences of experts in the industry itself.

It is one of a series which includes a Productivity Report on U.S. Galvanising, and Manuals on Costing and Good House Keeping and Safety.

There is now a great deal of information on the Hot Dip Galvanising process and in my view the authors have performed an excellent job in combining so much useful theory and practice in such a confined space. It will be much appreciated by managers and supervisors in the industry and perhaps will stimulate a demand for a larger publication where the results of research can be discussed in detail against an economic background.

If the test of any particular good practice is an economic one then a compromise may be necessary between two opposing ones to give the cheapest result. Slow withdrawal speeds will give lower zinc costs but the labour cost per ton may be higher and there is an optimum condition. Sulphuric acid pickling, which is less often used in England than hydrochloric acid may be justified under certain conditions of high density output. The choice of "wet" galvanising or " dry " galvanising is also largely dictated by economics or the type of work processed.

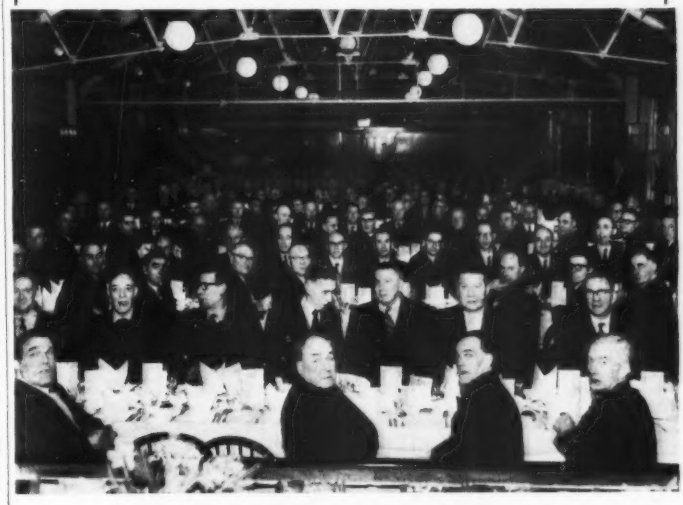
There are two details which must be queried. In Fig. 1 the photomicrograph of a typical galvanised coating is labelled .0015". Surely a typical coating would be better described as .003"-.004" thick. In Fig. 2 since quite large tonnages are processed at 450/460°C. for immersion times of around or below 60 secs., it would have been instructive to have this part of the graph expanded.

Apart from these minor points the booklet appears to be accurate and to be an essential in any galvanising plant.

E.F.P.

FINISHING NEWS REVIEW

Dinner to Celebrate the Score



INAUGURATION OF EMPLOYEES' CLUB

ON an evening last month, 250 employees and ex-employees of W. Canning and Co. Ltd., the Birmingham firm of metal finishing plant manufacturers, sat down to the inaugural dinner of the " 20 Club." Sir Ernest R. Canning was elected president of the club and silver badges were issued to mark its formation. Qualification for membership is 20 years service with the company.

It is interesting to note that the combined service of those who attended this dinner was something like 8,000 years, and out of a current total of approximately 2,000 employees 12½ per cent have been with the company for 20 years or longer. An interesting point is that Mr. S. S. Dawson, sales director, who is chairman of the " 20 Club " committee was present at the inauguration of the G.E.C. Magnet Club at Witton nearly 50 years ago, and was honorary secretary from 1908 to 1912.

TRADE and TECHNICAL PUBLICATIONS

"Temperature Measurement and Control": Publication No. 1700/S1 under this title is available from Electroflo Meters Co. Ltd., Abbey Road, Park Royal, London, N.W.10, a member of the Elliott-Automation Group. It outlines the company's range of pyrometers for a variety of industrial processes, including controllers, recorders, indicators and potentiometers. Reference is made particularly to the physical characteristics of the unique galvanometer movement weighing only 2 g., and to the complete range of measuring elements manufactured by the company.

"Lassovic P.V.C. Self-Adhesive Tape" is a brochure issued by Smith and Nephew Ltd., Bessemer Road, Welwyn Garden City, Herts., to describe the product.

Lassovic is a plasticised polyvinyl chloride sheet spread on one side with a tie-coated pressure-sensitive adhesive.

It is suitable for insulating and protecting electrical parts, especially those carrying high voltages under damp and oily conditions; colour identification of electrical parts; sealing apertures against oil, water, acids, dust, etc.; sealing joints; stopping-off in electro-plating processes and container sealing.

Available in a wide range of colours which make it extremely suitable for identification purposes, the aircraft industry in particular finds the tape ideal for identifying electrical circuits. It can also be used for sealing apertures against oil, water, acids, dust, etc.

The brochure has a price list and an 8-colour chart enclosed. Two other colours are to be added to the range in the near future.

"Technical Instruction for Sel-Rex 'Silvrex' Bright Silver Process": An 8-page technical paper has been prepared by the Sel-Rex Corpn., 75, River Road, Nutley, New Jersey, to describe their new bright silver plating process.

The new literature covers in detail such topics as bath make-up and maintenance; anodes, tanks, temperature; current densities; agitation; plating procedure; and simplified removal of solution impurities.

Introduced to the trade recently, the process is said to give a mirror-bright finish directly from the bath through a complete range from flash to extra heavy deposits, and produces hard (Brinnel 135) highly ductile deposits.

Other features of the process are: that it operates at room temperature, there are less fumes, and less tendency toward bath decomposition. It is noncritical, and is operable in a wide range of current densities—from 10 to 40 amp. per sq. ft. Its throwing power affords uniform thickness of plating even in "blind holes" and crevices.

A free copy of the instructions can be obtained by writing directly to the company.

"Everybody's Guide to National Insurance" is a new edition of a booklet prepared by the Ministry of Pensions and National Insurance and the Central Office of Information to explain briefly how the system of national insurance works. From H.M.S.O., price 6d. (by post 8d.).

MEETINGS OF THE MONTH

February 17

The Institute of Vitreous Enamellers Ltd. (Midland Section). "Design," by W. A. Ross, at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham. 7.30 p.m.

Institute of Metal Finishing (Organic Finishing Group). "Health Problems in Metal Finishing," by A. R. Thompson, at the Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, London, W.1. 6.30 p.m.

February 19

Institute of Metal Finishing (Organic Finishing Group). "Fire Hazards in Organic Finishing and their Avoidance," by L. A. Smith, at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham 2. 6.30 p.m.

February 21

Oil and Colour Chemists' Association (Midlands Section). "Organic Polymerization," by J. E. Stuckey, at Regent House, St. Philip's Place, Birmingham. 6.30 p.m.

February 27

Oil and Colour Chemists' Association (Scottish Section). "Some aspects of Film Structure in Emulsion Paints," by Dr. O. Neill (Paint Research Station), at the North British Hotel, Edinburgh. 7.15 p.m.

March 4

Institute of Metal Finishing (Midland Branch). "Recent Developments in Bright Nickel Plating," by A. Smart, at the James Watt Institute, Great Charles Street, Birmingham. 6.30 p.m.

March 6

Birmingham, Paint, Varnish and Lacquer Club. "The Use of Additives in the Paint Industry," by J. H. W. Turner, at the Imperial Hotel, Temple Street, Birmingham. 7.50 p.m.

March 13

Oil and Colour Chemists' Association (Scottish Section). "Review of Developments in Emulsion Paints," by A. C. Fletcher (Vinyl Products Ltd.), at More's Hotel, India Street, Glasgow.

BRITISH STANDARD FOR WIRE BRUSHES

HAND and rotary brushes filled with wire are the subject of a new British Standard, B.S. 2939: 1958, which has been prepared by representatives of the wire brush industry, local authorities and hospitals, government departments and the services. The new specification deals with wire scratch brushes, casting brushes, platers' brushes, scrubs, brooms, rotary cup brushes, and with a wide range of types for the removal of carbon, scale, paint, etc. from metal surfaces (when mounted on portable pneumatic or electric tools and on stationary grinders).

Many of the brushes were originally dealt with in War Office Specification No. TG. 26, and while the British Standard may thus be regarded as superseding TG. 26, it includes, at the request of the manufacturers many brushes not previously standardized.

With certain limilations, the representative committee has framed the requirements in terms which will include hand-drawn and machine-made brushes, so that the standard can be applied to the whole output of the wire brush industry.

The specifications are likely to prove helpful to purchasing authorities and will enable manufacturers to simplify their production.

The standard is available from the British Standards Institution, British Standards House, 2, Park Street, London, W.1. Price 7/6d.

Zinc Production in O.E.E.C. Countries

TOTAL refined zinc production in the Organisation for European Economic Co-operation producer countries, Austria, Belgium and the Belgian Congo, France, Germany, Italy, the Netherlands, Norway and the United Kingdom — amounted to 68,136 metric tons in November 1957, as compared with 70,530 metric tons in October 1957, a decrease of 3 per cent. As compared with November 1956, there is an increase of 3 per cent.

Of the 68,136 metric tons, 23,000 were of high and special grade zinc, while the remainder was classified as G.O.B., debased.

The United Kingdom's contribution to the total of slab zinc for October was 6,661 tons, all of second quality.

Highest producer was Belgium and the Belgian Congo, with a total of 24,397 tons of which nearly half was first grade zinc.

Slab zinc is defined as refined metal produced from ores and concentrates and scrap, excluding remelted metal, and top grade zinc is specified as being of a minimum of 99.95 per cent.

CADMIUM FROM THE GOVERNMENT STOCK-PILE

THE Board of Trade has announced that in accordance with the policy set out in the 1956 Defence White Paper on running down strategic holdings of industrial raw materials, they intend to dispose of 12¼ tons of cadmium metal in rod form which represents the final balance of the stockpile. This material is being offered immediately for sale by open tender for delivery before the end of March, 1958.

Forms of tender can be obtained from the Board of Trade, General Division 7, Lacon House, Theobalds Road, London, W.C.1.

Price Increases for Borax

PRICE increases for their products to take effect from February 17 have been announced by Borax Consolidated Ltd., Borax House, Carlisle Place, London, S.W.1., and Borax and Chemicals Ltd., 35, Piccadilly, London, W.1. The increases, which range from 30s. to 50s. per ton depending on the product, are due to constantly increasing costs.

GOLD MEDAL FOR I.C.I. DEPUTY CHIEF

DR. R. HOLROYD, deputy chairman of Imperial Chemical Industries, has been appointed Castner Medallist for 1958.

The Castner gold medal of the Society of Chemical Industry was instituted to commemorate the work of Hamilton Young Castner and is one of the Society's senior awards. The medal is awarded every two years.

Previous Castner Medallists are Sir Alexander Fleck, F.R.S., Dr. Christian Aall, Dr. Robert Swain and Sir Christopher Hinton, F.R.S.

The Castner Medal was designed by the distinguished medallist Mr. T. H. Paget and is struck by the Royal Mint.

The Medal has been exhibited in the Royal Academy and was taken to the first post-war meeting of Masters of Mints as an outstanding example of British Medal design.

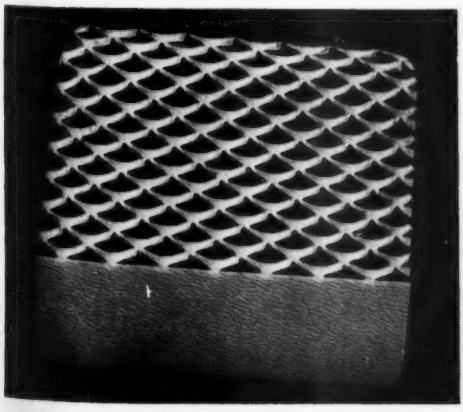
PLASTIC-COATED STEEL

NEW applications for "Stelvetite," the plastic coated steel sheet recently introduced by John Summers and Sons Ltd., Shotton, Chester, and reported in this journal, are continually being found.

The most remarkable feature of Stelvetite is that it can be worked and treated as ordinary steel sheet, while its outer surface retains all the characteristics of P.V.C. plastic, produced in a varied range of colours and embossed patterns. The outer plastic surface is a permanent, complete finish in itself, being extremely easy to clean and maintain.

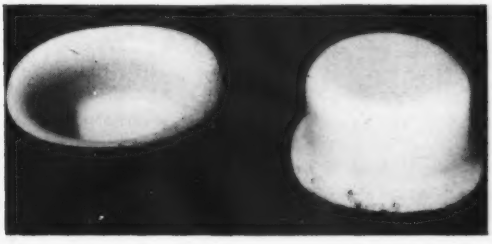
Developed exclusively by John Summers & Sons Ltd., in conjunction with B.X. Plastics Ltd., Stelvetite is strip mill cold reduced steel with a specially formulated Velbex P.V.C. coating. The reverse side of the sheet can be either a bonderised steel or electro-zinc-coated surface. It can be bent, formed, seamed, deep drawn, joined and welded without damaging the coating and is warm and pleasant to the touch.

Stelvetite is available in steel gauges from 26G (.0196″) to 16G (.0625″), and in sheet lengths and widths of up to 144″ and 48″ respectively. The P.V.C. coating is .014″ thick. It can be supplied in almost any colour, in any of the Stelvetite range of embossings.



Left.—An example of expanded "Stelvetite." The P.V.C. adheres well at the sheared edges.

Below.—Examples of deep-drawn Swift cups, showing the P.V.C. on the outside and inside.



Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Cleaning of Components during Fabrication

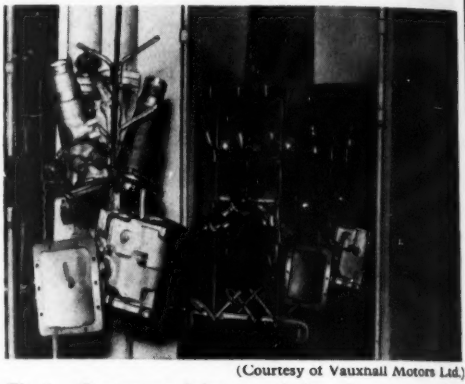
CLEANING of components to remove oil, grease and swarf, is always needed as a climax to the fabrication process. But often cleaning operations are necessary at intermediate stages of manufacture, and they can then become a heavy charge on the costs of production.

A new cleaner, "Pyroclean No. 8," recently introduced by the Metal Finishing Division of The Pyrene Co. Ltd., Great West Road, Brentford, Mddx., now enables the cost of component cleaning to be reduced, the makers claim.

Among the manufacturers using the new cleaner are Vauxhall Motors Ltd., Luton, Beds., who are employing the material in their new factory to clean all gearbox component parts. In their gear shop, Pyroclean No. 8 is used in spray washing equipment for removing oil and carbon specks derived from oil quenching after heat treatment In Fig. 1, components are shown being passed through a conveyorised spray-washing machine.

The cleaner is a mild, activated alkali powder that can be used in any kind of spray washing machine to clean ferrous and non-ferrous metal parts. Economy in use is derived from the very low concentration at which the cleaner is used (1 to 2 lb. per 100 gallons of water) and its low operating temperature, between 130 and 160°F. depending upon local production circumstances. It can be employed in any application where alkali or emulsion cleaners are ordinarily operated, and for many purposes it can replace solvent vapour degreasing.

The material contains no caustic or other harsh ingredient, and presents no problem of effluent disposal. When used for cleaning, subsequent rinsing in water is unnecessary, and a degree of corrosion resistance is imparted sufficient to last for periods of temporary storage.



(Courtesy of Vauxhall Motors Ltd.)

Fig. 1.—Components being passed through a conveyorized spray washing machine at the Luton works of Vauxhall Motors Ltd.

Anatase Pigment

A NEW anatase pigment for the surface coating and allied industries has recently been introduced by British Titan Products Co. Ltd., York, England.

Termed Anatase LF, it is a fine particle, modified titanium oxide pigment with the anatase crystal structure. It has been added to the firm's range of titanium pigments because of what is claimed to be its supreme whiteness allied to good dispersion characteristics in applications where existing anatase or rutile grades are not entirely satisfactory. The makers say that it has a very high brightness and a remarkably clean neutral tone that makes it very suitable for all applications where optimum whiteness is of prime importance.

During manufacture, the material is subjected to intensive milling, and is processed to eliminate oversize particles. It therefore requires the minimum of grinding for its incorporation into all types of media, and is suitable for any method of milling. Because of its low soluble salt content and its special treatment, it gives trouble free performance in all media which are sensitive to electrolytes.

Anatase LF is specially treated to improve its photochemical properties, and is more resistant to fading. It is also slightly more chalk resistant than Anatase E or Anatase HR, and can therefore be used in exterior finishes in conjunction with Rutile pigments to exercise fine control of chalking where this is desired. The chalk resistance of Anatase LF, however, does not approach that of Rutiox CR or Rutiox HD, and its use should be avoided in exterior finishes which are required to have maximum resistance to chalking.

A Heavy-duty Box Furnace

A GENERAL purpose heavy-duty box-type furnace has now been included in the range made by Hedin Ltd., Commerce Estate, South Woodford, London, E.18. (Fig. 2).

A typical model has internal dimensions of 54 in. x 24 in. x 18 in. and is rated at 60 kW with a maximum working temperature of 1150°C. Notable

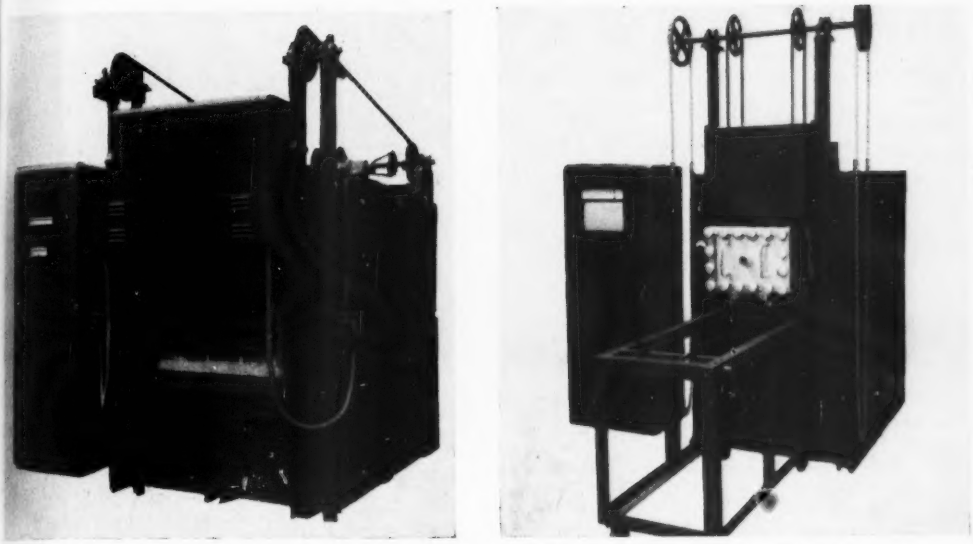


Fig. 2.—(a) Box furnace with automatic control and (b) manual control, with charging trolley

features are a press-button operated door, a non-distorting hearth, and efficient thermal insulation. The heating elements are in heavy section 80/20 nickel-chromium and operate on a low voltage via a transformer. Elements are fitted into the door, as well as the walls of the heating chamber, to ensure an even temperature throughout.

The temperature control is fully automatic and includes safety devices such as an indicating controller which can be set a few degrees above the operating temperature to provide a protection for the charge as well as the heating elements.

A further safety measure is the inclusion of a second contactor, which takes over in the event of the contacts sticking on the operating contactor. There is also an E.A.C. single-phase preventor. In the event of one phase being affected, this instrument immediately cuts the other two phases to prevent an out-of-balance load. The whole of this equipment is housed in a floor cubicle.

The furnaces are now available with a complete range of atmosphere and vacuum containers for the treatment of non-ferrous or special metals. The unit illustrated in Fig. 2 (b) is a typical example and is shown complete with container and charging trolley. The furnace shown in this illustration is the hand-operated version of the range. When the furnaces are used in conjunction with an atmosphere or vacuum, the containers are designed to suit whatever application is required. For example, if a hydrogen or nitrogen atmosphere is to be used, the trolley is equipped with the necessary gauges, and accommodation is provided on the trolley for gas cylinders, to provide a self-contained unit that can be completely removed for cooling purposes, leaving the furnace free for another charge.

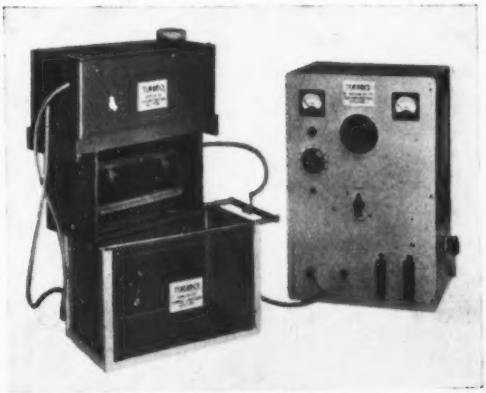
Because of the rapid heating possible in these furnaces, many heat-treatment applications are possible, including vitreous enamelling.

Plating Unit and P.V.C. Hoods

WITH the increasing demand for silver and gold plating of small electronic contacts Turner and Brown Ltd., chemical plant engineers, Bolton, have designed and manufactured the "Turbro" miniature barrel plating unit of 20-oz. capacity, resistant to all solutions up to 69°C.

The unit comprises a rectifier with automatic timing device controlling the D.C. supply to the

Fig. 3.—Miniature plating unit.



bath and the supply to the fractional-h.p. A.C. electric motor, 2 tanks and a plating barrel constructed from P.V.C. (Fig. 3).

Outstanding features of the plating barrel are that it is lightweight, portable, and incorporates its own electric motor so that it is easily adaptable for use in any normal still bath plating tanks.

The P.V.C. gears permit a barrel speed of 14 r.p.m. to provide adequate solution agitation during electro-deposition and an even distribution of plating. Small perforations in the barrel ensure the retention of very small parts. Simple door fasteners facilitate barrel loading and unloading. Larger machines can be supplied to customers requirements.

Using an entirely new method of construction, Turner and Brown have designed and manufactured a number of exceptionally large P.V.C. acid-resisting fume hoods.

The hoods rely on their strength upon mild steel tubing, completely sealed in P.V.C. Specially designed jointing unions permit the framework to be built to any design speedily and efficiently.

After assembly of the main framework, it is sheeted in with an $\frac{1}{8}$ thick " Cobex " rigid P.V.C.

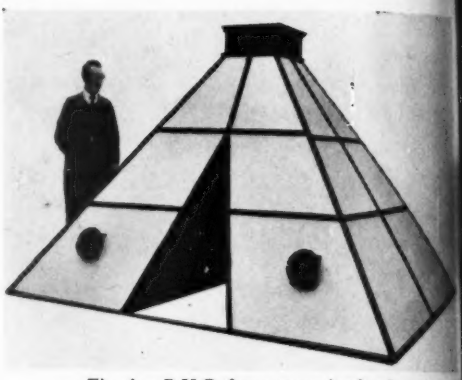


Fig. 4.—P.V.C. fume extraction hood

Using this method of construction, hoods can be transported in one section, if required.

The manufacturers claim that complete protection from acid fumes is obtained with the hoods.

" Turbro " fume hoods can be supplied with transparent " Cobex " P.V.C. sheeting or alternatively opaque sheeting with porthole light fittings as shown in Fig. 4.

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